Visionary Imaging

ROTOGRAPH-D

(120V version)

Service manual

Release 30 November 2006 (Rev. 0)

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This manual in English is the original version.

1. INTRODUCTION

NOTE:
The present manual is updated for the product it is sold with in order to grant an adequate reference in performing diagnostics and repair operations normally carried out by the service engineer.
The manual may not reflect changes to the product not impacting service operations.

ROTOGRAPH-D, by DENT-X, is a radiological device which allows users to carry out radiological examinations of the dental maxillo facial complex, when used in conjunction with the digital image acquisition software ProImage.

ROTOGRAPH-D is available in a single version for the execution of:

- PANORAMIC examination
- Temporo-Mandibular Joint (TMJ) examination
- SINUS examination.

This manual provides to the operator the instructions for proper and safe use of the appliance.

The appliance must be used strictly following the procedures described in this manual and never for activities other than those for which it was designed.

Before using the appliance, we recommend to read carefully this manual. Keep it in a safe place near the unit for future reference.

is an electro-medical appliance and may be used only under medical supervision, i.e. with the supervision of highly qualified persons with the necessary know-how regarding X-ray protection.

The user is responsible for complying with the legal requirements regarding the installation and operation of the equipment.

1.1 Icons appearing in the manual

Indicates a "NOTE"; the utmost attention shall be devoted to the reading of paragraphs marked by this icon.

Indicates a "WARNING"; paragraphs marked with this icon cover patient and/or operator safety aspects.

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2. SAFETY INFORMATION

WARNING:
Read this chapter very carefully.

VILLA SISTEMI MEDICALI S.p.a. and DENT-X designs and manufactures equipment in compliance with safety requirements; moreover, it provides all the necessary information for correct utilization as well as warnings related to risks associated to X-ray generators.

VILLA SISTEMI MEDICALI S.P.A. and DENT-X shall not be responsible for:

- any use of the ROTOGRAPH-D different from that for which it has been designed,
- any damage to the equipment, the operator or the patient caused either by incorrect installation and maintenance not compliant with the procedures contained in the relevant user's and installation manuals provided with the equipment, or by incorrect operation techniques,
- any mechanical and/or electrical changes effected during or after installation, different from those reported in the service manual.

Only qualified service personnel, authorized by DENT-X is allowed to perform technical interventions on the equipment.

Only authorized personnel are allowed to remove the tube head from its support and access the internal components.

2.1 Warnings

The system has not been designed to be used in the presence of vapors, nitrous oxide, or anesthetics mixtures that are flammable with air or oxygen.

Ensure that water or other liquids do not get into the machine so as to prevent short-circuits and corrosion.

Always disconnect from main power supply before cleaning the machine.

Where necessary, accessories such as lead-sealed aprons must be used to protect the patient from radiation.

Only the patient and the operator may remain in the room during the execution of the radiography examination.

ROTOGRAPH-D has been developed for continuous use with intermittent load. The prescribed operating cycles, specifically those which allow the heat accumulated by the radiogenic source to be discharged must be observed.

Although the appliance has been designed to have a reasonable degree of protection from electromagnetic interference, it must be installed at a certain distance from electricity transformer rooms, static continuity units, portable two-way hand radios, and cellular phones. The latter may only be used at a distance of over 1.5 meters from all elements of the machine.

All instruments or equipment for professional use and used near the machine must be in conformance to the electromagnetic compatibility standards. Nonconforming instruments whose low immunity to electromagnetic fields is known must be installed at least 3 meters away from ROTOGRAPH-D and be powered via an independent electric line.

ROTOGRAPH-D must be switched off during the entire period of use of ESU (Electro Surgery Units) units or similar equipment.

Clean or eventually disinfect the chin support, positioning handles, temple clamp supports, nose rest and any other part that may come in touch with the patient.

At the end of the examination, replace the bite and the ear rods.

Although the X-ray dosage supplied by dental radiology appliances is on average low and distributed over a relatively small surface, the operator must take the necessary precautions and/or follow the safety procedures for both himself and the patient during an exposure. We recommend that the X-ray activation always be commanded from an X-ray protected area via remote control. If it is necessary to operate the exposure near the patient, remain at the maximum distance allowed by the remote control cable in the direction opposite to the emission of the X-rays, at a distance of at least 78 ¾ inches (2 meters) from both the radiation source and patient.

2.2 Environmental risk and disposal

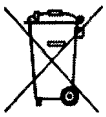
A number of machine parts contain materials and liquids that upon completion of the machine's life cycle must be disposed of at recovery centers established by the local health units.

The machine contains the following materials and/or components:

- **Tube head:** dielectric oil, lead, copper, iron, aluminum, glass, tungsten
- **Control box and remote control:** iron, copper, glass resin, non-biodegradable plastic casings
- **Column, rotating arm, extensions:** iron, lead, aluminum, copper, non-biodegradable plastic materials, glass resin.

WARNING:
Before disassembling the parts, lock the counterweight of the slider inserted in the column. This is possible only after having slid the slider all the way down and inserted a pin approximately 25cm in length and 8mm in diameter. Once the pin has been inserted, move the slider towards the top until the counterweight rests on the pin. Remove the tube head and some of the parts of the rotating arm. Holding the slider firmly, remove the pin and move the slider towards the top to the metallic stop of the column. At this point, remove all the remaining parts.

2.3 Symbols used

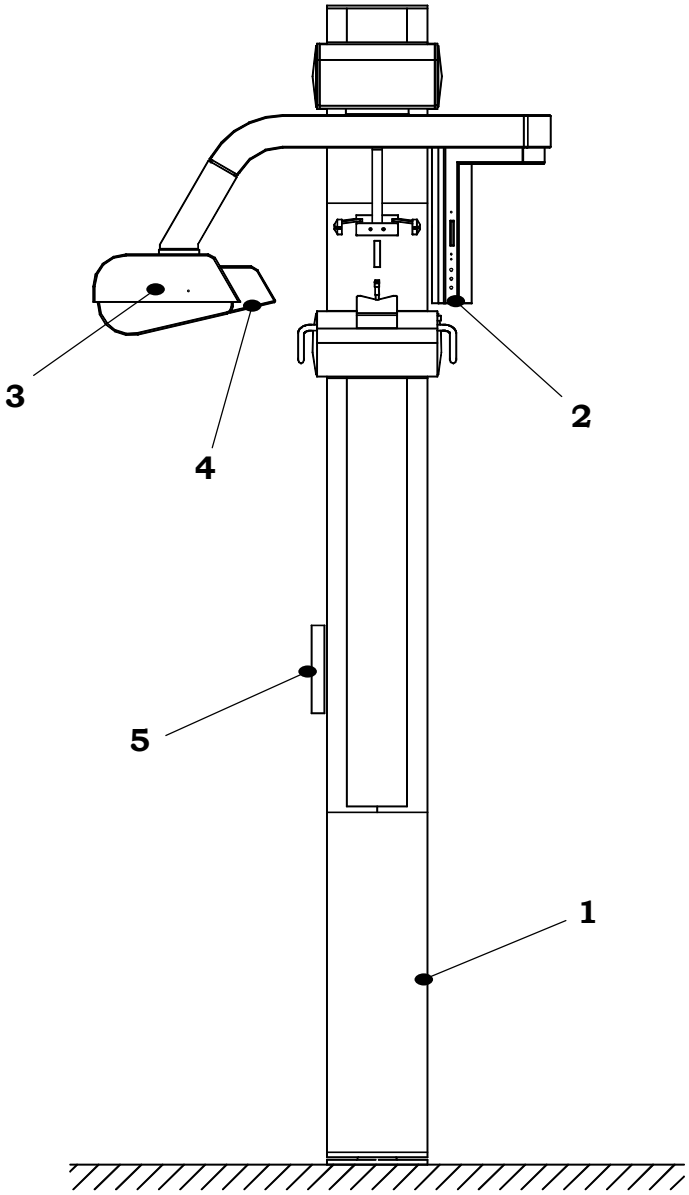
Symbol	Description
	Equipment with Type B applied parts (according to IEC 601-1)
	A number of machine parts contain materials and liquids that upon completion of the machine's life cycle must be disposed of at recovery centers established by the local health units
~	Alternating Current
N	Connection to neutral conductor
L	Connection to line conductor
	Protection ground
	Functional ground
	OFF ; equipment not connected to power line
	ON ; equipment connected to power line
	Warning: read the documentation provided with the unit

3. DESCRIPTION

3.1 Identification labels

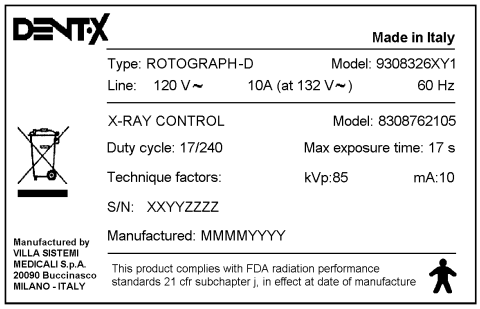
The ROTOGRAPH-D is labeled with a set of labels identifying different components according to the requirements of the international standards.

The following picture shows the position of the different labels:



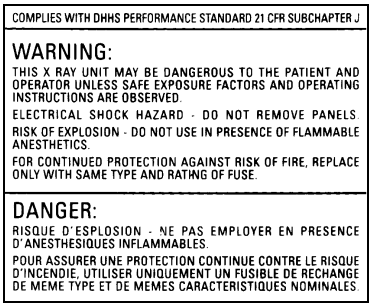
1a

ROTOGRAPH-D label


Made in Italy
Type: ROTOGRAPH-D
Model: 9308326XY1
Line: 120 V~ 10A (at 132 V~) 60 Hz
X-RAY CONTROL
Model: 8308762105
Duty cycle: 17/240
Max exposure time: 17 s
Technique factors:
kVp:85
mA:10
S/N: XXYYZZZZ
Manufactured: MMMMYYYY
Manufactured by VILLA SISTEMI MEDICALI S.p.A. 20090 Buccinasco MILANO - ITALY
This product complies with FDA radiation performance standards 21 cfr subchapter j, in effect at date of manufacture

1b

WARNING label

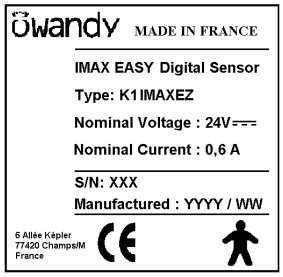

COMPLIES WITH DHHS PERFORMANCE STANDARD 21 CFR SUBCHAPTER J
WARNING:
THIS X RAY UNIT MAY BE DANGEROUS TO THE PATIENT AND OPERATOR UNLESS SAFE EXPOSURE FACTORS AND OPERATING INSTRUCTIONS ARE OBSERVED.
ELECTRICAL SHOCK HAZARD - DO NOT REMOVE PANELS.
RISK OF EXPLOSION - DO NOT USE IN PRESENCE OF FLAMMABLE ANESTHETICS.
FOR CONTINUED PROTECTION AGAINST RISK OF FIRE, REPLACE ONLY WITH SAME TYPE AND RATING OF FUSE.
DANGER:
RISQUE D'ESPLOSION - NE PAS EMPLOYER EN PRESENCE D'ANESTHESIQUES INFLAMMABLES.
POUR ASSURER UNE PROTECTION CONTINUE CONTRE LE RISQUE D'INCENDIE, UTILISER UNIQUEMENT UN FUSIBLE DE RECHANGE DE MEME TYPE ET DE MEMES CARACTERISTIQUES NOMINALES.

1c

ETL certification label

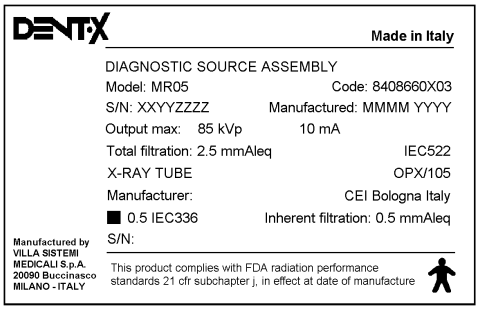
2

Digital Sensor identification label



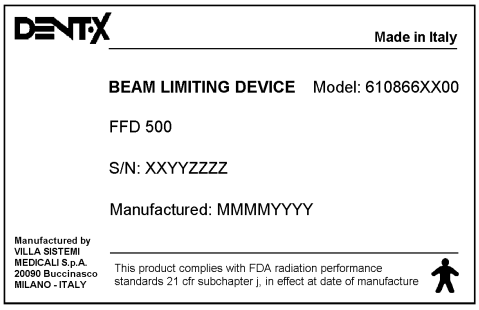
3

Tube head identification label



4

Collimator identification label


Made in Italy
BEAM LIMITING DEVICE Model: 610866XX00
FFD 500
S/N: XXYYZZZZ
Manufactured: MMMMYYYY
Manufactured by VILLA SISTEMI MEDICALI S.p.A. 20090 Buccinasco MILANO - ITALY
This product complies with FDA radiation performance standards 21 cfr subchapter j, in effect at date of manufacture

5

Remote control identification label

Manufacturer: Villa Sistemi Medicali S.p.A.
via delle Azalee, 3 - 20090 Buccinasco ITALY
HAND HELD CONTROL
Model: 7208760003
S/N: XXYYZZZZ
Manufactured: MMMM YYYY
This product complies with FDA radiation performance standards 21 CFR subchapter j, in effect at date of manufacture

3.2 Description

ROTOGRAPH-D has been designed to perform the following examinations:

- Panoramic examination
- "SINUS" examination of the Para nasal sinus
- Examination of the Temporo-Mandibular Joints (TMJ) with open or closed mouth on a single image

All the allowed examinations may be made with different parameters according to the setting of the remote-control (please refer to the specific chapter of this manual).

ROTOGRAPH-D is controlled by a soft touch console and equipped with an alphanumeric digital display for a clear indication of the working parameters and operative messages. The operative cycle is entirely run by a microprocessor, controlling its different modes: from programming of the emission parameters according to the chosen examination and the patient's size, to the voltage fluctuation and to the notification of possible anomalies, failures, or errors.

The excellent quality radiographs thus obtained is the result of a clever design based upon the pseudo-elliptic rotation system, the original light beam-luminous cross pattern centering system, and most of all the small dimension of the focal spot, in addition to the digital quality of the solid state RX sensor.

This particular rotation system allows an orthogonal imaging of all teeth and wide image layer with an optimum focused zone of 10 mm for the incisors and 20 mm for the molars.

ROTOGRAPH-D, besides operating in the programmed mode, can also operate in the manual personalized mode by modification of the parameters.

In the Panoramic and TMJ modes, with all interlock enabled, it is possible to activate the **TEST** push button **(31)** (see Figure 7-7 at the end of the manual).

The **TEST** functioning mode allows the operator to check the functionality of the selected examination cycle or to show to the patient the examination he will undergo, including all movements of the machine, without emitting X-rays.

The **TEST** and **X-Ray** push buttons are “dead man” button. This means that if they are released during the examination cycle, the latter is interrupted stopping the movements in progress. To re-start the cycle first reset the unit by means of the key **32** (Figure 7-7), than start again the function which was interrupted.

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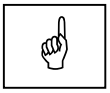
4. TECHNICAL FEATURES

General characteristics	
Equipment	ROTOGRAPH-D
Manufacturer	VILLA SISTEMI MEDICALI Buccinasco (MI) Italy
Class	Class II according to 21 CFR sub-chapter J. Class I with type B applied parts according to IEC.
Degree of protection	IP20
Rated line voltage	120V ± 10%
Line frequency	60Hz
Max line current at 108V, 85kV, 10mA (Note 2)	10A rms momentary; 0.5A stand-by
Maximum power	1.15 kVA at 108V
Power fuse	10A T
Command fuse	0.5A T
Filament fuse	0.315A F
Line voltage regulation	≤ 3% at 108V
Compensation of the mains voltage fluctuation	automatic
High voltage	60-85 kV (5 kV steps)
KV accuracy	± 10% @ 120V ± 10%
Anodic current	10 mA
Anodic current accuracy	± 1.5 mA @ 120V ± 10%
Exposure time **(Panoramic)**	17s adult 14s child
Exposure time **(TMJ1 + TMJ2)**	10.4s adult 9.4s child
Exposure interval (PAN & TMJ)	240s (1:16 duty cycle)
Height of irradiated area on sensor	5 ⅝" (143 mm)
Image mean enlargement (PAN & TMJ)	1.2 : 1



NOTE:
Due to technology used to compensate the line voltage fluctuations, the maximum of line current absorbed from the line is at the lowest voltage (108V).

Tube head features	
Type	MR05
Manufacturer	VILLA SISTEMI MEDICALI S.p.a. Buccinasco (MI) Italy
Max peak tube potential	85 kV
Nominal power	0.630 kW (85kVp, 10mA)
Total filtration	2.5mm Al eq. at 85 kV
Insulation	Oil bath
Cooling	Ambient
Leakage radiation at 1 m	< 0.25 mGy/h (85 kV, 10mA, 1:16 duty cycle)
Maximum power	85 kVp, 10mA
Type of circuit	Single-phase, self-rectifying
X-ray tube features	
Manufacturer	VILLA SISTEMI MEDICALI S.p.a. Buccinasco (MI) Italy
Type	CEI OPX/105
Focus	0.5 IEC 336
Inherent filtration	0.5 mm Al eq.
Anode tilt	5°
Anode material	Tungsten
Nominal voltage	105 kVp
Filament maximum current	4A
Filament maximum voltage	8V
Anode thermal capacity	30 kJ
Weight of apparatus and parts	
Slider net weight	121.3 pounds (55 kg)
Column net weight	106 pounds (48 kg)
Tube head net weight	53 pounds (24 kg)
Control unit net weight	62 pounds (28 kg)
Slider counterweights net weight	198.5 pounds (90 kg)

Environmental conditions	
Maximum operating temperature range	+50°F ÷ +104°F (+10° ÷ +40°)
Operating relative humidity range	30% ÷ 75%
Transportation and storage temperature range	-4°F ÷ +158°F (-20° ÷ +70°)
Maximum transportation and storage relative humidity	< 90% non condensing
Minimum atmospheric pressure for transportation and storage	630 hPa

4.1 Standards and regulation

The ROTOGRAPH-D is manufactured according to the following standards:

21 CFR subchapter J

General safety:
- IEC 601-1
- IEC 601-1-1
- IEC 601-2-7
- IEC 601-2-28
- IEC 601-2-32
- UL 2601

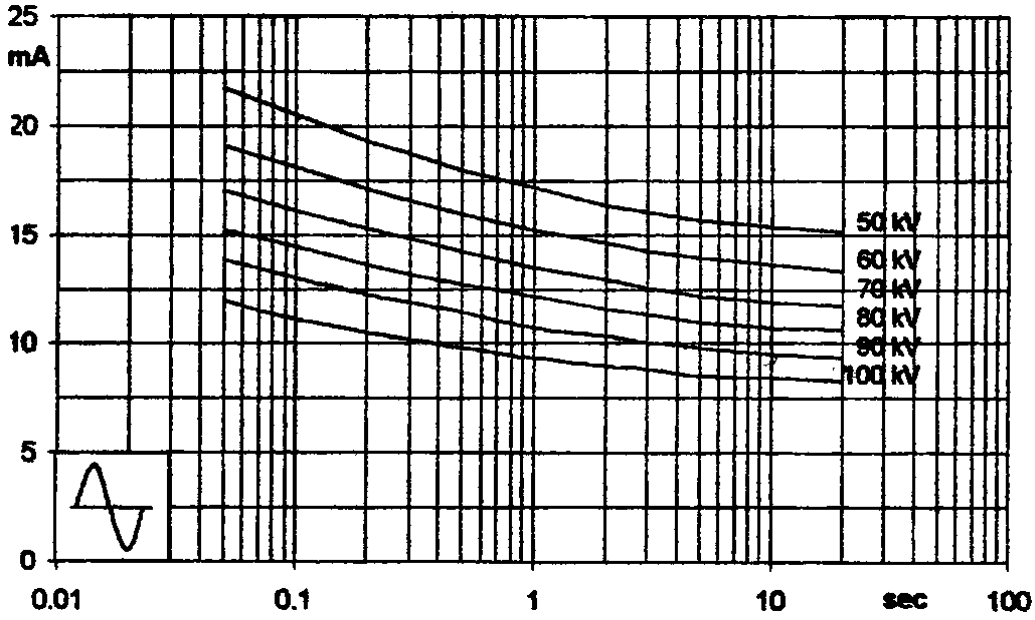
Electromagnetic compatibility
- IEC 601-1-2

Protection from radiation
- IEC 601-1-3

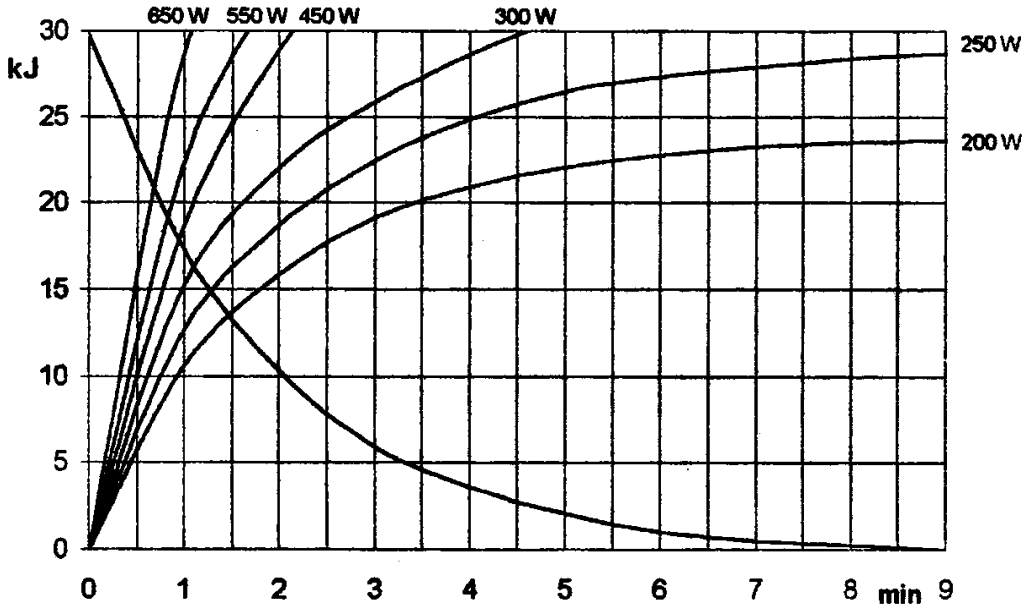
4.2 X-ray tube head curves

4.2.1 Tube "CEI - OPX/105" (0.5x0.5)

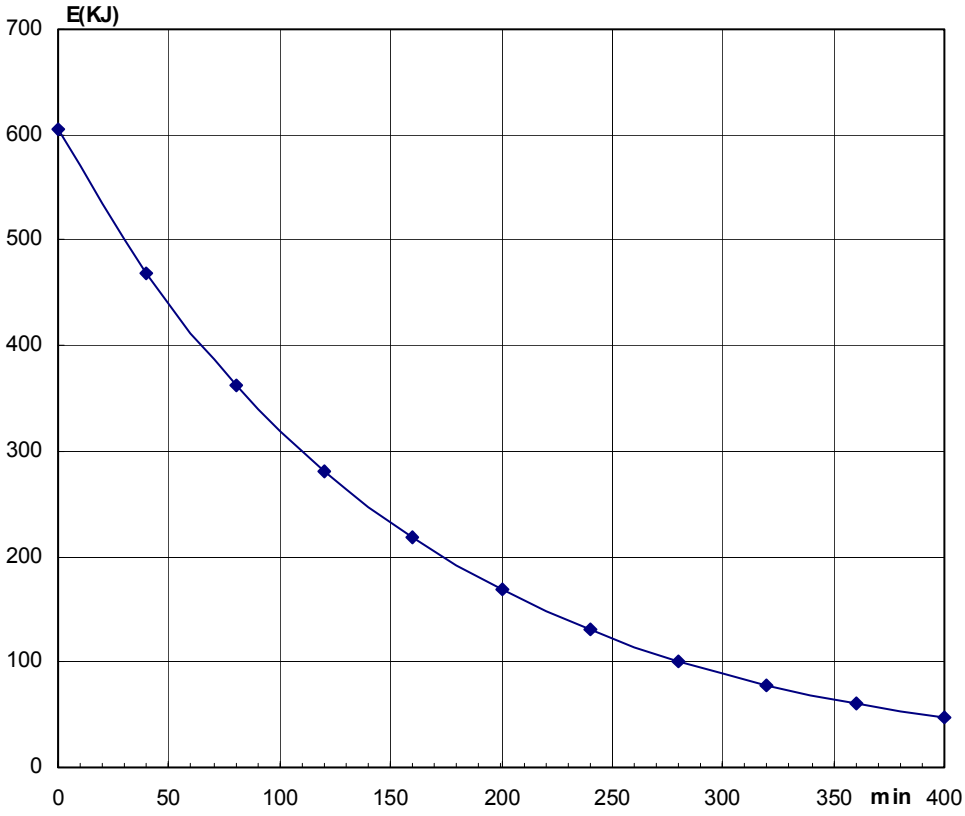
Loading chard



Anode cooling chard



Cooling curve of tube head



4.3 Technical factors measuring method

kV_p The peak tube potential is directly measured with a non invasive kVp-meter, accuracy ±3kVp. When performing the measurement, make sure that measuring probe is completely covered by the X-ray beam. A direct measurement of the high voltage can only be carried out by specialized technicians in a suitable testing laboratory as it requires disassembling of the tube head.

mA The output current is determined by measuring the voltage drop on a resistor (1kΩ, 5%) using a digital multimeter, connected to the corresponding plugs, as indicated on paragraph 7.4 (digital multimeter set to VDC 20V, 1V=1mA).

t The exposure times are determined by using a timer/counter, having an accuracy of 0.1%, measuring the duration of part of the voltage applied to the primary side of the tube head, during the exposure phase.

4.4 Overall dimension

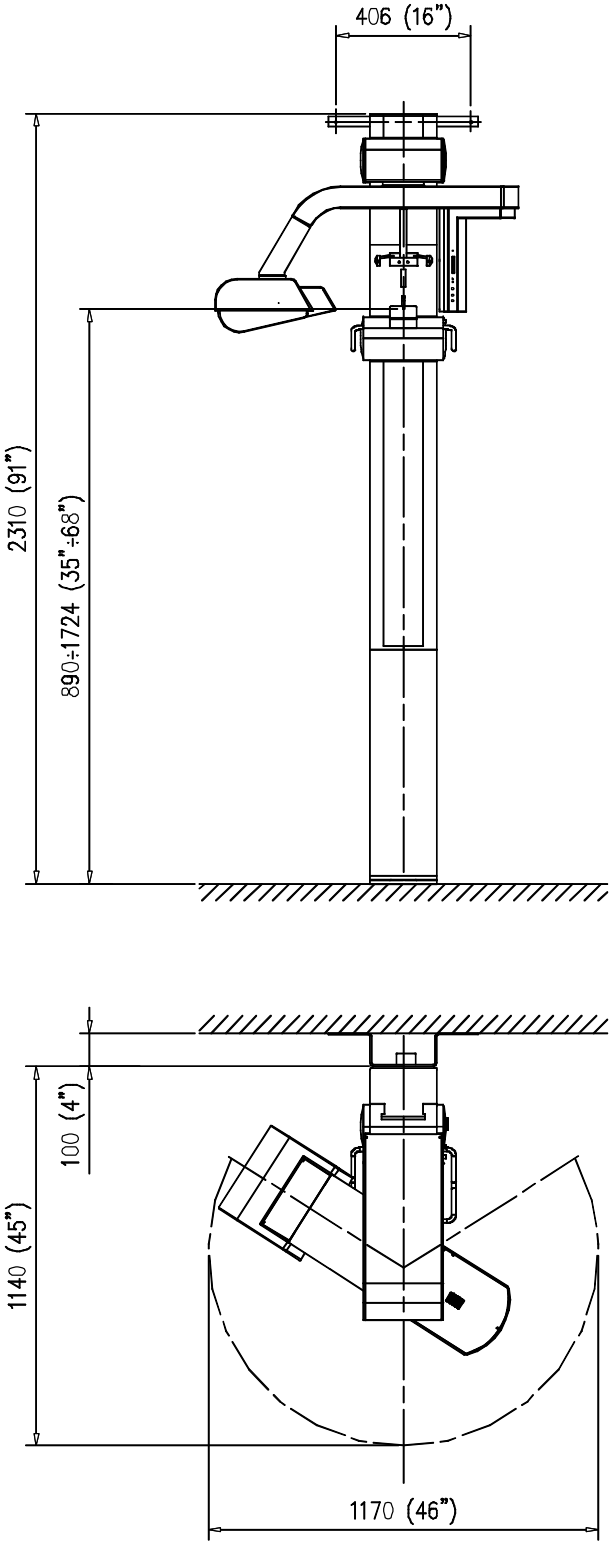


Figure 4-1: ROTOGRAPH-D overall dimension

5. PRE-INSTALLATION

Please carefully read the information provided in this chapter in order to ensure proper functioning of the ROTOGRAPH-D.
The supplier is able to provide assistance and the necessary technical advice necessary for the pre-installation phase; building works and the pre-installation phase are to be charged to the customer and must be made according to the information provided.
The room pre-installation requirements for a successful installation are:

- A minimum room ceiling height of 8 ft (2.5 mt) and an area to accept the ROTOGRAPH-D with its different configuration as showed in Figure 5-1.
- To transport the system into the room the doors must have a minimum width of 36" (80cm).

5.1 Electrical requirements

- Supply single phase + ground — 120V ± 10%
- Frequency — 60 Hz
- Power input — 1,1 kVA
- Max current — 10A (at 108V)
- Apparent mains resistence — 0.5Ω max

WARNING:
The equipment must be connected to a breaker conforming with the electrical standards in force in the country of installation.
It is mandatory to use a "Magnetothermal" breaker to separate the appliance from the mains.
The equipment is provided with a connecting cable of the type SJT AWG 16 (1,5mm²).
Grounding of this equipment must meet any standards in force.

NOTE:
The ROTOGRAPH-D IS PROVIDED with connections for remote control and signalling device to be placed at the entrance of the X-ray room with the following meanings:

- **REMOTE EXPOSURE BUTTON:** X-ray exposures can be commanded by means of remote button to avoid operator presence on the examination room. This push button must be "dead man" type
- **READY Light:** (Green light 24V 40W max) signals the unit readiness to make an X-ray exposure
- **X-RAY Light:** (Yellow light 24V 40W max) signals "a no entrance condition" due to radiation emission.

In order to connect these devices, a 5 wire conductor cable of AWG 18 (0,5mm²) must be prepared prior to the complete installation.

WARNING:
21 CFR requires that indication of the technique factors be visible from the operator's position. In case of use of the remote button the Manufacturer expressly by this warning, disclaims any responsibility, as to compliance to Federal Regulations. It is responsibility of the installers to observe and abide by the rules.

NOTE:
The electrical connection has to be made on the X15 terminal (refer to Figure 6-7 and the general wiring diagram at chapter 9.).

5.2 Environmental condition

The performance of the equipment are assured if the room environment must be treated in such a way as to ensure a relative humidity between 50% and 75 % and a temperature between +50°F ÷ +104°F (+10° ÷ +40°).

WARNING:
Proper backing is absolutely essential for all wall mounted versions. The wall bracket supplied must be attached to the wall bearing in mind that the wall backing has a capacity to sustain a load of 2000N (about 441 pounds - 200kg) per bolt applied. Backing and proper support is the full responsibility of the owner.

5.3 Unpacking

The ROTOGRAPH-D is shipped packed in three cartons.
Dimensions, net weight, gross weight and the packing contents are listed in the following table:

Packing dimension	Contents	Weight	
		Net	Gross
40x37½x29½ inches (100x95x75 cm)	- Motor group - Tube head - Counterweights - Accessories	330.7 pounds (150 kg)	363.8 pounds (165 kg)
98½x8¾x7 inches (240x22x30 cm)	- Column	88.2 pounds (40 kg)	99.2 pounds (45 kg)
45¼x7x7 inches (115x30x30 cm)	- Column counterweight	178.6 pounds (81 kg)	189.6 pounds (86 kg)

5.4 Space requirements

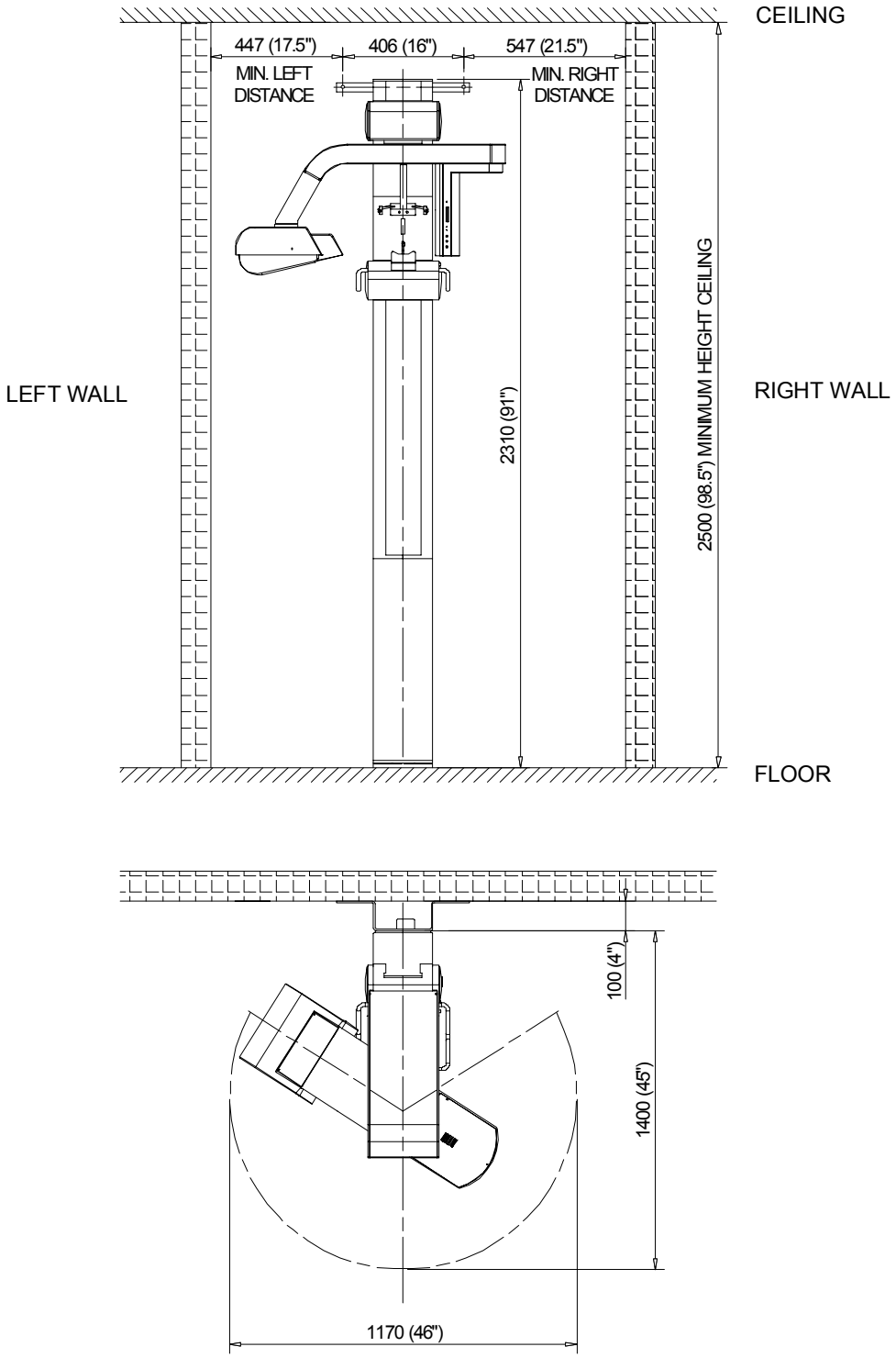


Figure 5-1

6. INSTALLATION

NOTE:
The ROTOGRAPH-D is dispatched preassembled in groups.
The mechanical assembly consists exclusively in assembling these groups together.
Calibration of the ball bearing, brakes and eventual tightening torques is factory preset before delivery; any intervention on these parts, besides not being necessary, can cause malfunction.

Depending on the configuration of the unit, the following fixing methods must be used:

	Fix legs to floor	Use wall bracket	Fix column to floor
Version with legs	•		
Version without legs		•	•

6.1 Version with legs

After unpacking the components, proceed to assemble in the following order:

1. Rest the column on two wooden blocks with the guide turned upwards.
2. Assemble the legs by means of the 4 fastening screws. All assembly screws are inserted into the respective housing holes and must be removed before each assembly phase.

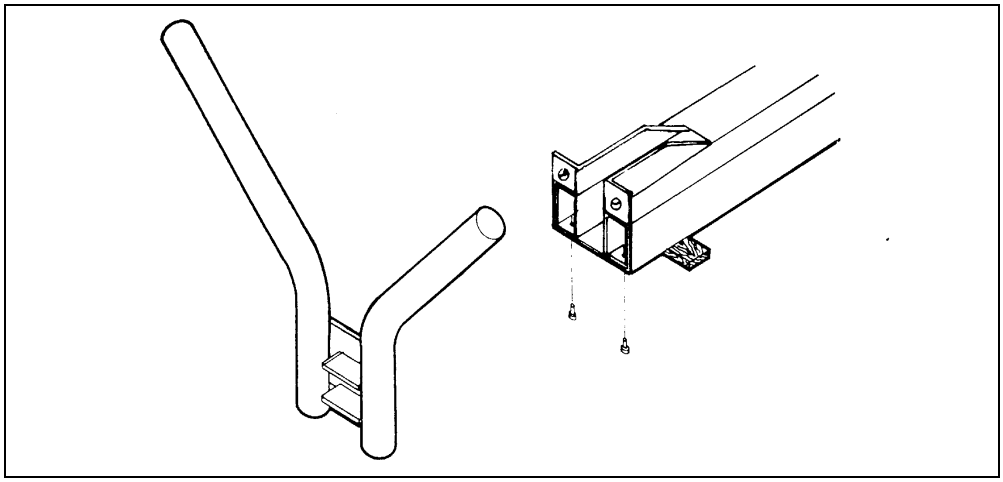


Figure 6-1

3. Insert the counterweight stop pin into the appropriate hole located at about mid-stand.
4. Position the counterweight (154 pounds - 70 kg) with the flat surface upwards, and the rear pocket facing backwards.
5. Insert the counterweight in the column and push it against the stop, making sure that the metal ropes are not crossed.

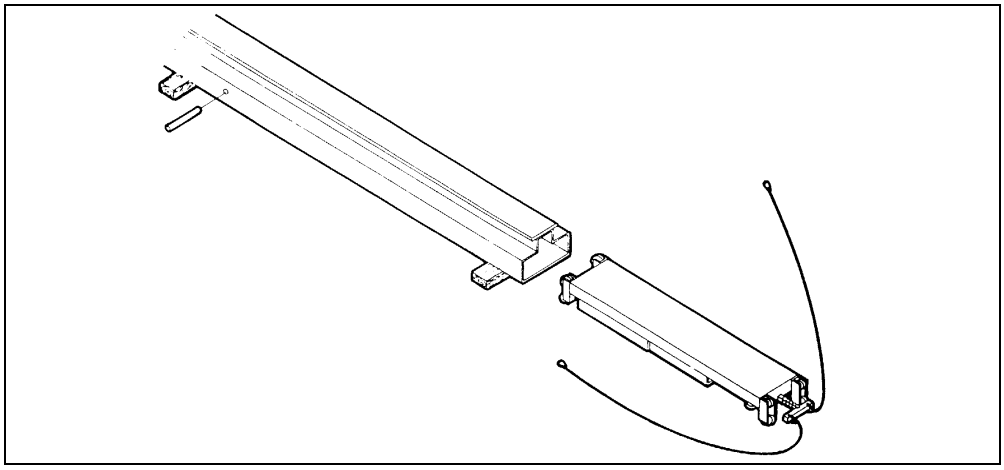


Figure 6-2

6. Align the motor group sliding bearings (110 pounds - 50kg) with the appropriate guides. Remove the motor group upper stop pin and insert the unit (Figure 6-5), allowing only the last ten inches to extend from column. Care must be taken not to scratch the column.
7. Stretch the metal ropes, make sure that they are not crossed, curve the ends backwards and upwards and fasten them to the motor group with the appropriate screws, washers and spacers. Fully insert the motor group on the guide.

WARNING:
During insertion of the motor group on the guide, pay attention not to place your fingers between track and carriage: they may be seriously pinched.

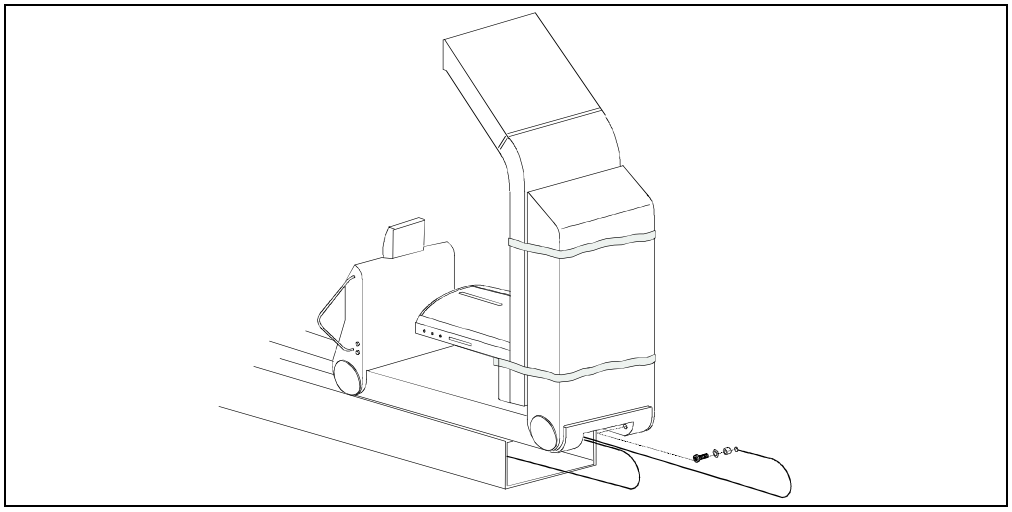


Figure 6-3

8. Assemble the pulley support with the respective ropes positioning the round corners in the front side of the column.

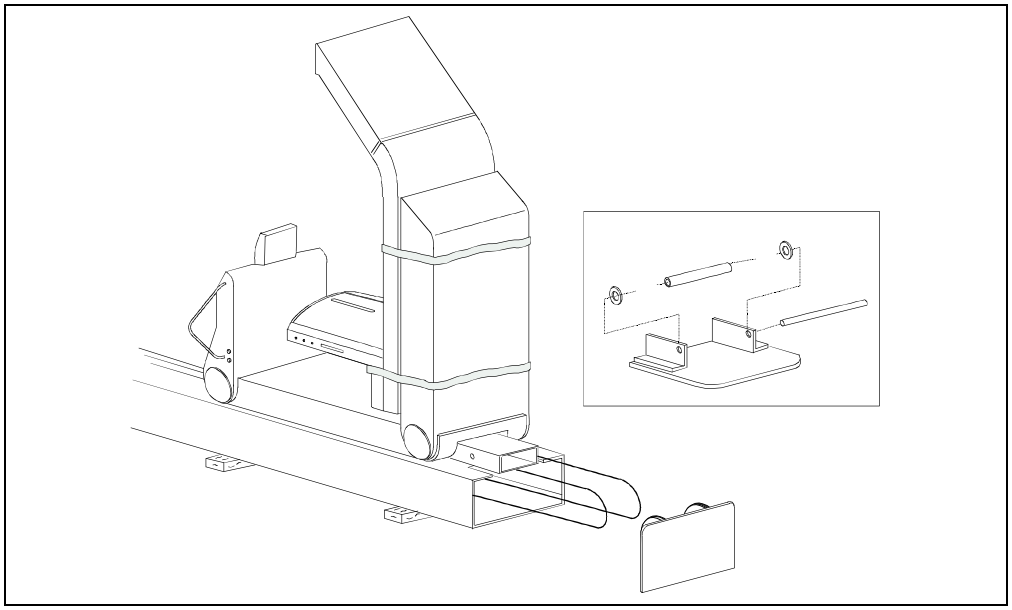


Figure 6-4

9. Keep the ropes under tension by acting on the pulley support and, checking that the ropes do not come out of their guides, by acting on the slider push the whole assembly until the pulley unit is inserted in its housing on the upper part of the column.

10. Assemble the motor group upper stop pin on the stand.

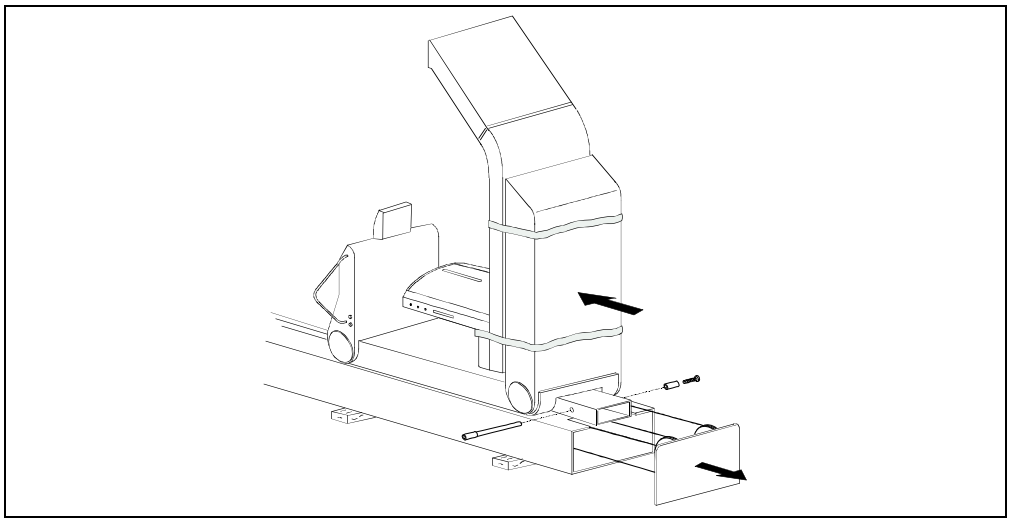


Figure 6-5

11. Position the column (375 pounds - 170kg) vertically and place it at a minimum distance of about 12" (30cm) from the wall.

12. Remove the tube head back cover plate and the safety plate.

13. Assemble the tube head by first inserting the cables and then the pin into the fastening bushing; secure it with the plate previously removed and connect the wires to the terminal strip making reference to Figure 6-6.

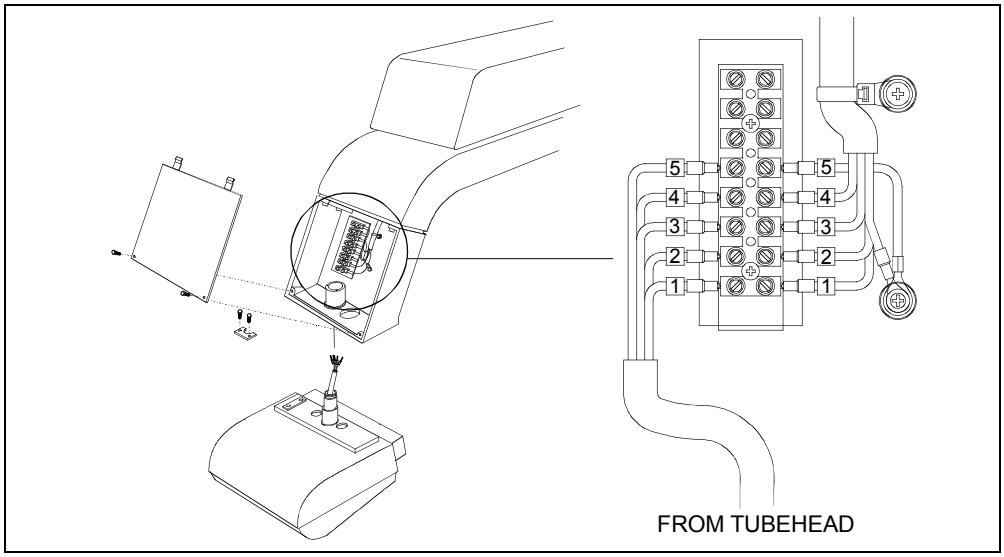


Figure 6-6

14. Install the HUB support (normally supplied with the accessories) in the rear part of the column as shown in Figure 6-7, tightening it with the two screws; fix the cables dedicated brackets.

15. Remove the packing material that is blocking the arm rotation and the counterweight stop pin.

16. Fix the cables routing it as shown in Figure 6-7.

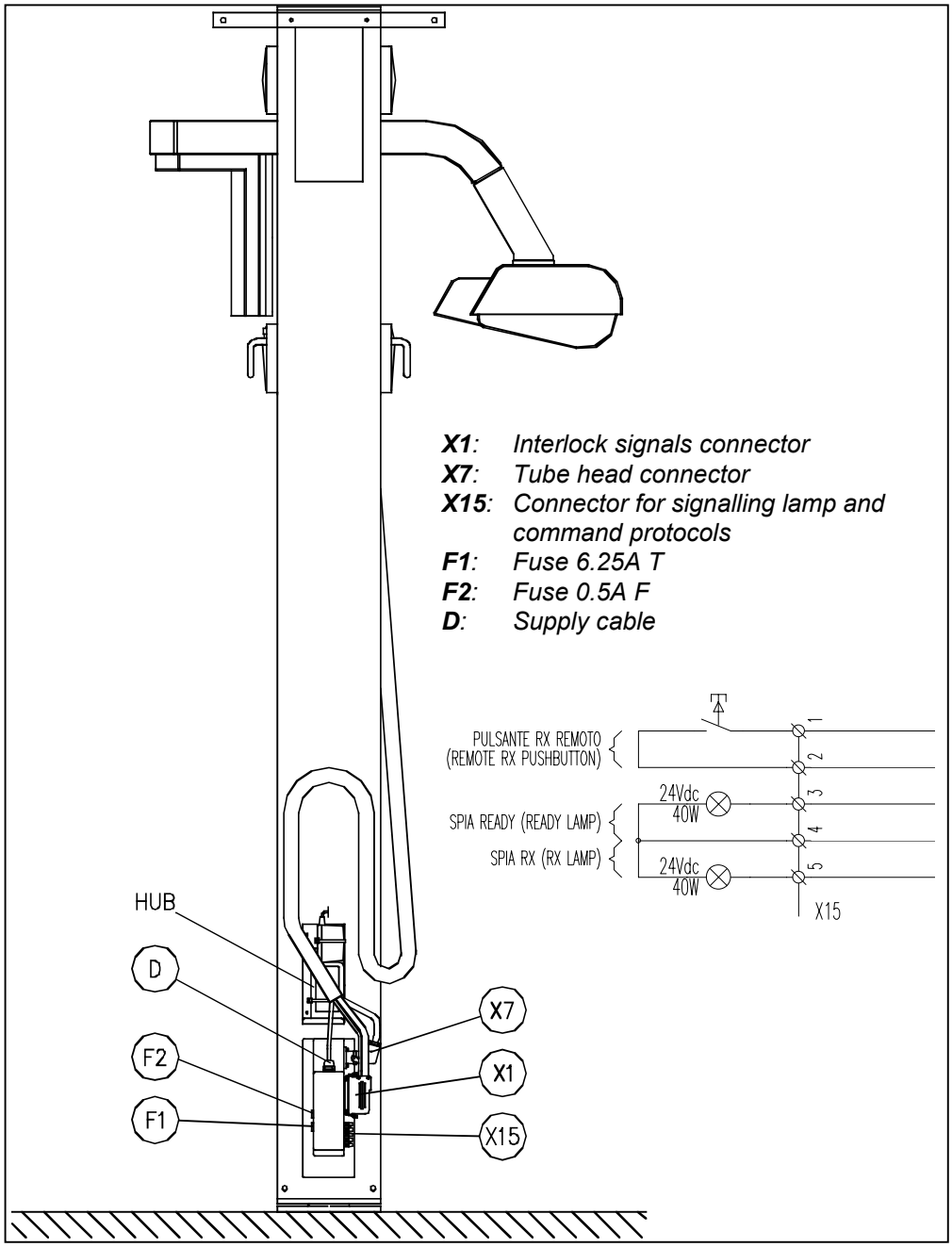


Figure 6-7

17. Connect X1 and X7 connector in the lower part of the control box and in upper side of chin rest board A3 and connect green/yellow grounding cable to the protection ground screws. Connect the USB/2 cable inside the corrugate duct and USB/2 cable (L=5mt) interfacing the PC (wait to connect the PC until this will be requested during the installation of the ROTOGRAPH-D Images Acquisition software).

18. Check to ensure the ROTOGRAPH-D is perpendicular to the floor by adjusting the 4 levelling screws located under the legs and assembles the support with the appropriate clamp.

19. Secure the unit to the floor by drilling the necessary 2 holes in the floor through the relevant predisposed holes on the legs, and using 2 8mm dowels (outer diameter = 8mm) provided with the unit (see next Figure).

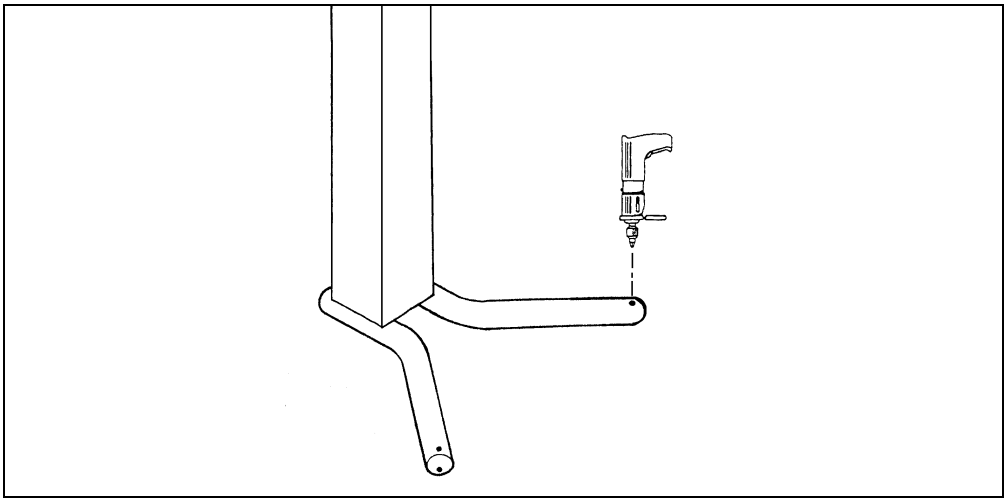


Figure 6-8

20. Power up the HUB with a normal line socket.

21. Turn on the main switch on the control box and proceed to calibrations as described in chapter 7.

6.2 Version without legs

After having unpacked the components proceed to assemble in the following order:

1. Support the column on two wooden blocks with the guide turned downwards.

2. Assemble the base plate and wall bracket with the appropriate fastening screws.

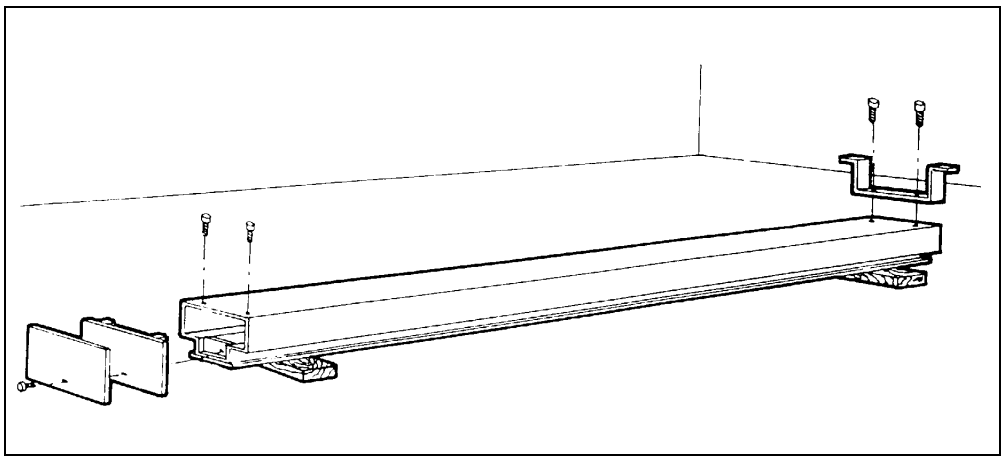


Figure 6-9

3. Raise the column, position it in the desired spot, taking the total overall dimensions into account, and align it by means of a bubble level.

4. On the wall and floor mark the position of the fastening holes corresponding to the base plate and wall bracket.

5. Put the column back on the floor, resting it on the wooden blocks, and remove the wall bracket.

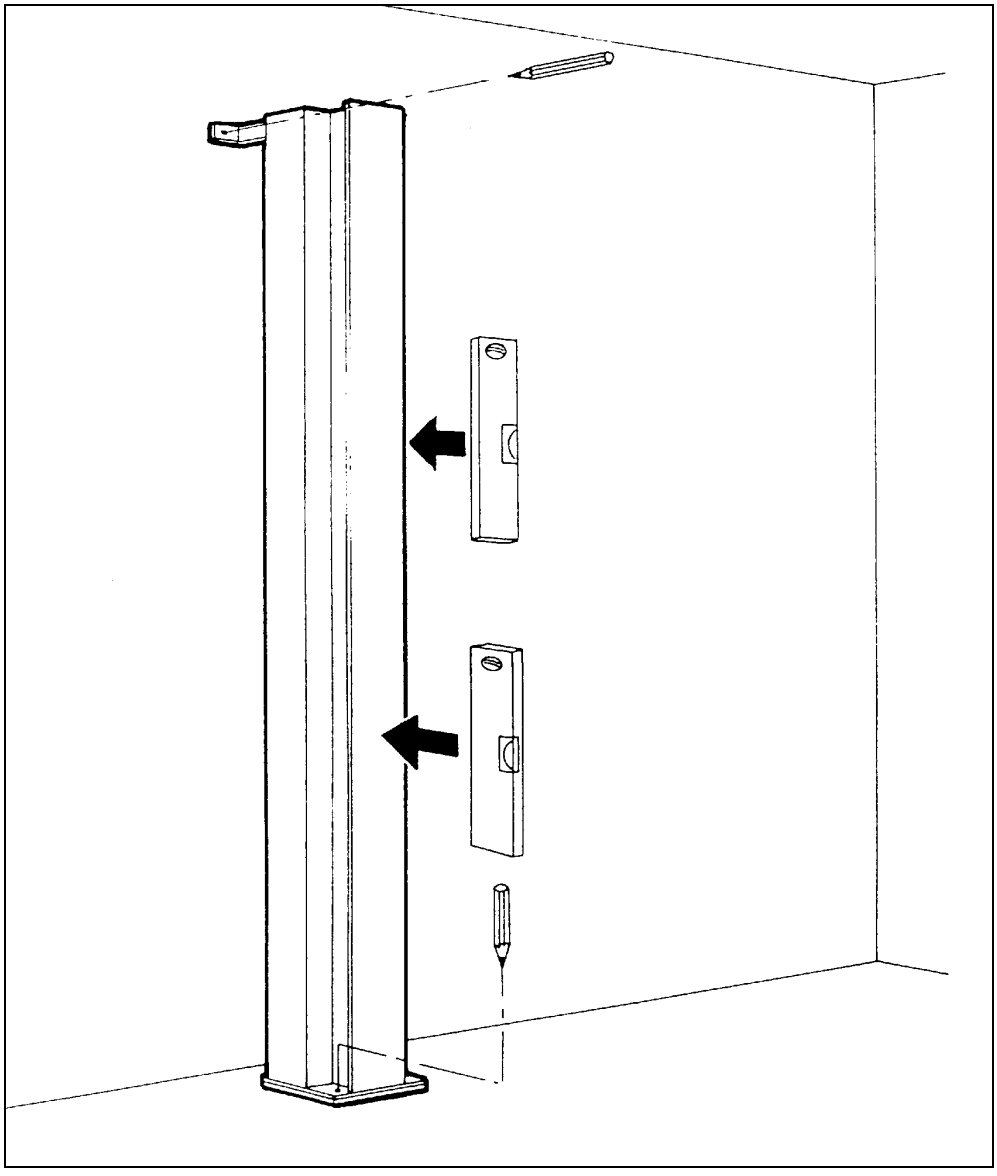


Figure 6-10

6. Drill wall and floor at the marks made previously.

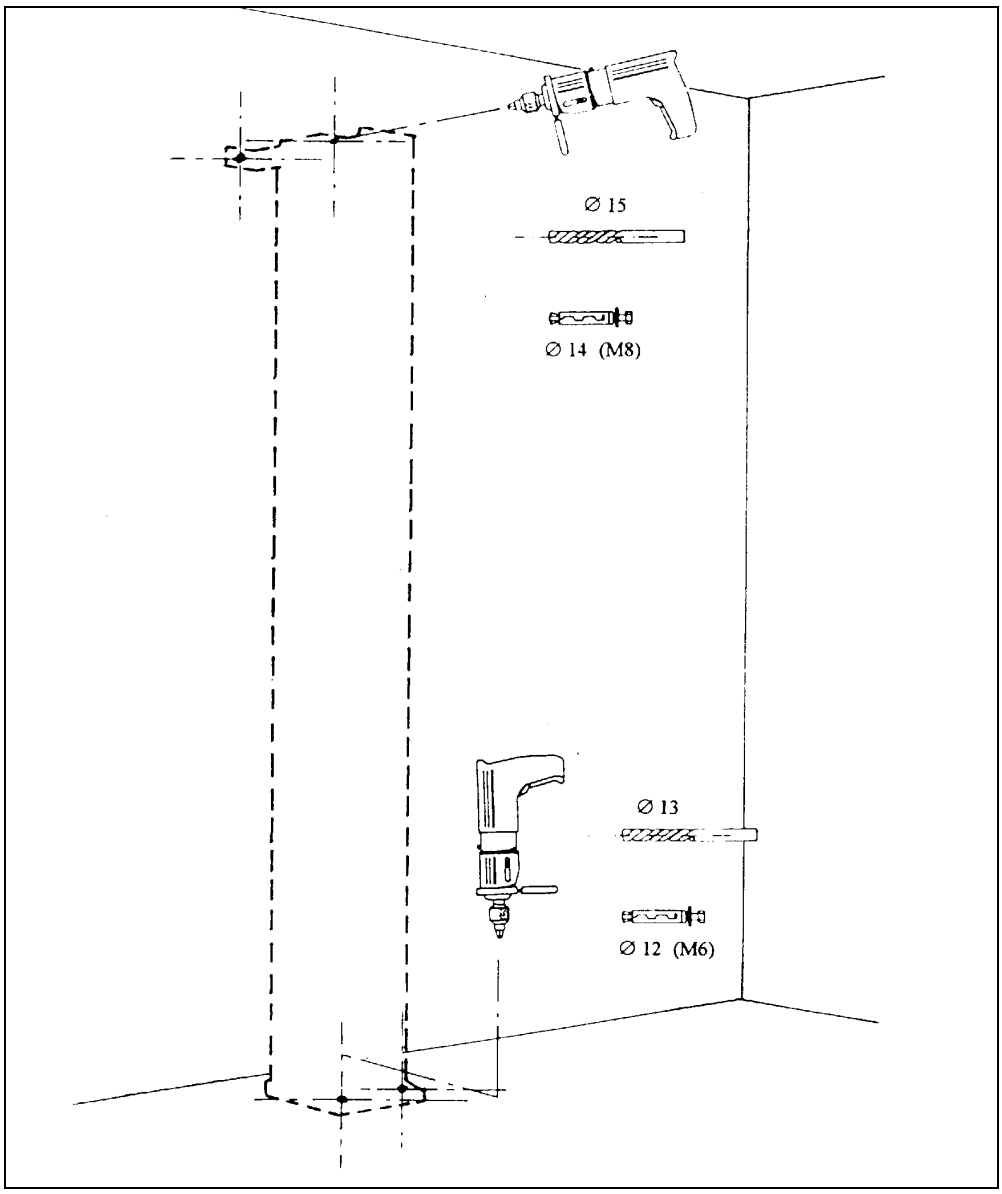


Figure 6-11

NOTE:
To fasten the wall bracket to masonry we recommend expanding metal dowels with an 8mm screw diameter. For the base plate it will be sufficient dowels with screw diam.6mm. Where a wooden support is utilized, we recommend a la bolt of 3/8" diameter.

7. Continue the assembly of the whole unit starting from point 6.1.3 , when reaching point 6.1.8. it will be necessary to reassemble the wall bracket ; before finally fastening, check again to ensure the unit is perpendicular to the floor.

8. Turn on the main switch on the control box and proceed to the calibrations, as described in chapter 7.

7. CHECKOUT AND ADJUSTMENTS

WARNING:
ALL THE FUNCTIONS OF THIS EQUIPMENT ARE PRE-CALIBRATED AND CHECKED DURING THE FINAL TESTING IN THE FACTORY. ANY CHANGES TO THE DEFAULT SETTINGS MAY ONLY BE CARRIED OUT BY A DENT-X TECHNICIAN OR BY EXPRESSELY AUTHORISED THIRD PARTIES. ANY CHANGES MADE BY UNAUTHORISED PEOPLE WILL VOID ANY MANUFACTURER'S RESPONSIBILITY AS TO THE CORRECT OPERATION AND SAFETY OF THIS EQUIPMENT.

NOTE:
The procedures explained in the next pages make often reference to Figure 7-6 and Figure 7-7 at the end of this chapter. To easily consult these Figures, unfold pages in order to make it visible while reading other pages of the manual.

7.1 Power up

When turning on the machine, before pressing any key on the remote control wait for the CPU and remote control initial self-test to end, until the remote control sets itself to **PAN** (27), **Adult** (33), **Medium size** (36).

If you press any key (except "**s**" (39), "**increase**" (41) and "**decrease**" (40)) during the self-test phase, such procedure will not be passed. The machine will wait for the key to be released and then will start its normal operation cycle.

Press "**increase**" (41) and "**decrease**" (40) during the self-test phase to increase or decrease the brightness of the display.

To access the set-up phase, press "**s**" (39) during the self-test procedure.

7.2 Set-up

This chapter explains how to enter same special routines (set-up mode) that allow carrying out adjustment / settings on the unit.

7.2.1 Activation of the set-up programs

Activation of the set-up mode is achieved as follow:

1. While holding the **"s"** button depressed, turn the machine ON and do not let go until the unit has gone through its check out mode which will be signaled by two distinct sound, one short and one long; thereafter, the display would be blank.
2. Press keys 37, 34, 29 in sequence (small, child, TMJ1 buttons; see Figure 7-7). The display will remain still blank.
3. The system is now waiting for one of the following selections:
   - press "**s**" (39) to change the value of the "software DIP-switches"
   - press "**R**" (32) to restore the default values of the operating parameters in the Non-volatile RAM (NVRAM) memory
   - press "**T**" (31) to calibrate the potentiometer used for the detection of the position of the rotating arm.

WARNING:
Pressing "**R**" will cause the loss of all factory and/or custom adjusted parameters.

7.2.2 Modification of the values of the "Software DIP-Switches"

To select the status of each of the “software DIP-Switches (S0 to SB), press the **“s”** key (39; see Figure 7-7).
To move to the next “software DIP-Switches”, press the **“T”** (31) key as many time as required to read the desired functions.
The available “software DIP-Switches” are the following:

S0: Display number of performed exposures

When the display indicates "S0 OFF", press "**s**" (39) to change this function to ON (S0 ON).
Now press "**R**" (32). By pressing the **Pan** (37), **TMJ1** (29), **TMJ2** (30) and **CEPH** (28) function keys, the system will display the number of the respective exposures performed. Do not press "**R**" (32) again.
To exit this set-up function (S0) and return to the normal working function, press "**s**" (39). S0 will return automatically to OFF (S0 OFF).
To proceed with the set-up functions, repeat the actions described at paragraph 7.2.

S1: Select display message language

When the display indicates "S1 set language", press "**s**" (39) to change the language of the display (ITA, ENG, FRA, DEU or ESP).
Once the desired language is selected, you can either go to the next functions by pressing "**T**" (31) or return to the normal working conditions by pressing "**R**" (32).

S2: Delay between two exposures, to allow tube head anode cooling

If S2 is ON, there will be a cooling pause after each exposure. If S2 is OFF, several exposures can be performed without any delay, which may affect the reliability of the tube head life.
Once the desired setting is selected by pressing "**s**" (39), you can either go to the next functions by pressing "**T**" (31) or return to the normal working conditions by pressing "**R**" (32).

NOTE:
It is recommended to leave this function **always ON** (S2 ON).

S3: Display AC line voltage

When the display indicates "S3 OFF", press "**s**" (39) to change it to ON (S3 ON).
Now press "**R**" (32) to display the line voltage value.
For further information regarding the adjustment of the AC voltage, see paragraph 7.3.
To exit the set-up function (S3), press "**T**" (31); S3 will return automatically to OFF (S3 OFF).
To proceed with the set-up functions, repeat the actions described at paragraph 7.2.

S4: Tube current control (mA) and X-ray centering control

When the display indicates "**S4 OFF",** press "**s**" to change this function to ON (S4 ON).
In this way you can perform X-ray beam centering without any rotation of the arm. Press the X-ray button (42) to display the AC voltage. For further information on tube current control, see paragraph 7.4. For X-ray beam centering control, see paragraph 7.5.
Once the desired setting is selected, you can either go to the next functions by pressing "**T**" (31) or return to the normal working function by pressing "**R**" (32).
In order to return to the normal working conditions, access the set-up function and set S4 to OFF.

S5: Angle (A...) & time (T...) control

When the display shows "**S5 OFF",** press "**s**" (39) to change this function to ON (S5 ON). Now you can access the procedure for checking the calibration and editing the various angles involved on the system's functionality.
For further information on the angle control function, see paragraph 7.6.

NOTE:
Press "**R**" (32) to exit the S5 function. This will not set automatically function S5 to OFF (S5 OFF) and after an exposure the string "**T1 020**" will be displayed.

To access the normal working function again, return to the set-up program and change S5 to OFF.

S6: Cephalometric device (not applicable to Digital version)

It is OFF. To access the next function, press "**T**" (31).

S7: Display brightness

By pressing "**s**" (39), this function allows to adjust the brightness of the display by choosing among a range of values from 0 (darkest setting) to 7 (brightest setting).
To return to the normal working condition and store at the same time the new configuration, press "**R**" (32). To access the next function, press "**T**" (31).

S8: Reset

If this setting is ON, the RESET function (the return of the arm after an exposure or after a TEST routine) will not be of "dead man" type, but a single pulse through the "**R**" button (32) will be required to obtain a complete arm travel.
To return to the normal working condition and store at the same time the new configuration, press "**R**" (32). To access the next function, press "**T**" (31).

S9: Not enabled

SA: Tube head angular position

When the display indicates "**SA OFF",** press "**s**" (39) to change this function to ON (SA ON). You will thus be able to display the tube head angular position during the set-up phase only.
Press "**R**" (32) to display the actual angle.
Press "**T**" (31) to perform a Test function; the display will show the rotating arm angular position reached (0°÷245°) during all run.
To return to 0°, press and keep pressed "**R**" (32).
To exit the set-up function, press "**s**" (39). The SA value will automatically return to OFF (SA OFF).

SB: TMJ examination enabling

This function allows for disabling the TMJ examination feature.
SB=ON will allow the function, while SB=OFF will disable it.
Pressing the "**s**" (39) button changes the value.
The pressure of button "**T**" (31) will pass to the next parameter (in this case returning to S0) storing the selected value, while pressing the “X-ray emission” button (42) the set-up procedure will terminate storing the set value.

NOTE:
At the pressure of TMJ1 or TMJ2 button while the SB=OFF value has been stored, the message “TMJ function not allowed” will be visualised on the display.

7.2.3 Non-volatile memory reset

Press "**R**" (32). The system will emit a long beep. Press "**R**" again to confirm the reset of the default parameters in the non-volatile memory. **After pressing "R" for the second time, wait a few seconds without turning off the machine.** This will automatically return to the normal working condition.

NOTE:
If you press "**R**" once by mistake, you can exit the "Non-volatile memory reset" function and return to the normal working condition by pressing any key (except "**R**").

7.2.4 Potentiometer replacement/calibration

The procedure here after described, allows to store into the system non-volatile memory the resistance values of the potentiometer (then converted by the A to D Converter) when the tube-head is in the starting position (0°) and final position (245°).
In this way, the system can continuously detect the angular position of the arm by reading the value of the potentiometer attached to the mechanics.

NOTE 1:
The following procedure must be started with the machine OFF and cable X1 disconnected.

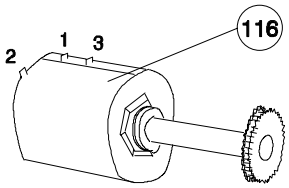
NOTE 2:
The following procedures, often requires to access the set-up programs; access to the programs is achieved as follows:

- **a** while holding the "**s**" (39) button depressed, turn the unit ON and do not let go until the unit has gone through its check out mode which will be signalled by 2 distinct sounds, one short and one long; thereafter, the display would be blank
- **b** press keys 37, 34, 29 in sequence (small, child, TMJ1 buttons); the display will remain still blank
- **c** Now the following keys, with the relevant functions, are active:
  - "**s**" (39) to change the value of the "software DIP-switches" (S0 to SB)
  - "**R**" (32) to restore the default parameters of the non-volatile memory
  - "**T**" (31) to calibrate the circuit associated to the potentiometer of the rotating arm.

Selection of the desired option is described within the procedure.

1. With the unit OFF, loosen the clutch of the belt motor.
2. Manually move gently the rotating arm to the 0° position, until reaching the relevant microswitch S2 (see Figure 7-1).
3. Check the value of the new potentiometer to install (5kΩ, 10kΩ or 20kΩ).

4. Depending on the value of the potentiometer, adjust it to read between pins 2 and 3 (see next Figure) a value of 350Ω±10 (for 5kΩ potentiometer), 700Ω±20 (for a 10kΩ potentiometer) or 1400Ω±30 (for a 20kΩ potentiometer).



5. Install the potentiometer on the unit.
6. Manually bring the arm to the central position and lock the clutch.
7. Connect cable X1, turn ON the unit and wait for the end of the initial self-test.
8. Press the "**R**" key (32; Reset); the arm will rotate up to reach the 0° position.
9. Switch OFF the unit ; switch it back ON by activating the set-up function (see above Note 2) and press the "**T**" (31) button: the display will shown A/D followed by a number; press the "**decrease**" key (40) to store the value corresponding to the **0**° position.
10. Press key "**T**" (31) to store the value.
11. Rotate the arm by pressing and holding the "**T**" key (31) checking that the end run angle is 245°.
12. Turn OFF the unit, turn it ON again by activating the set-up program (see above Note 2).
13. Press the "**T**" (31) key; the system will show on the remote-control display the reading of the A/D Converter corresponding to the angular position of the potentiometer (and therefore given by the relevant resistance value); at this point the display should indicate 223 (equivalent to 2.23 V) or a value approximate to this number.
14. Press the "**increase**" (41) key to store into memory this value as value corresponding to the **245**° position of the rotating arm.
15. Press the "**T**" (31) key to store the value and exit the set-up program.
16. Press the "**R**" (32) key to bring the arm in starting position.
17. Switch the unit OFF, then back ON, activate the set-up programs (see above Note 2) and press the "**s**" (39) key.
18. Press the "**T**" (31) key several times until showing SA OFF

19. Press the "**s**" (39) key to change to SA ON.

20. Press the "**R**" (32) key: the display will show A (means angle)= 000.0°.

21. Pressing and holding "**T**" (31) key, perform a test rotation and check that, during the rotation, the display will show a value increasing smoothly and constantly corresponding to actual angular position of the rotating arm; at the end of the rotation, the angle display will show 245°.

22. Press the "**s**" (39) key.

23. Press the "**R**" (32) key to bring the arm in starting position.

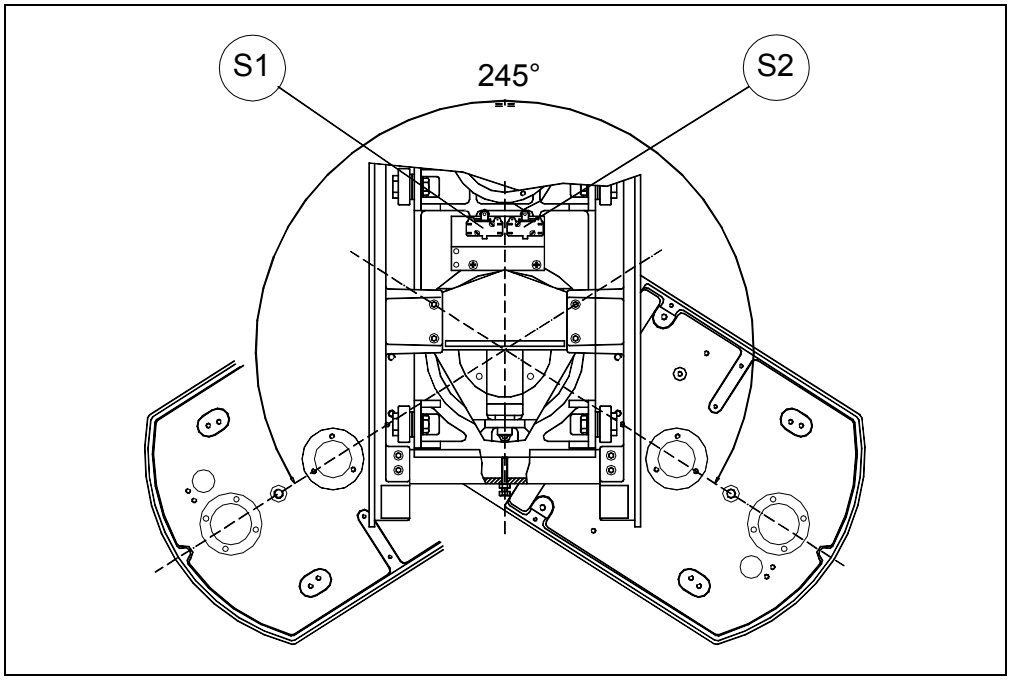


Figure 7-1

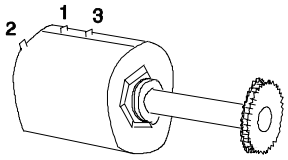
7.2.5 Arm Rotation Motor / Power Board A1 replacement

Arm rotation speed is very critical and affects the quality of the image. If either the arm rotation motor or the Power Board A1 is replaced, it's important to implement the procedure that is part of the spare part kit and at the end to verify the success of the intervention checking image symmetry as described in paragraph 7.7.4.

7.2.6 Rotation Start / Stop Microswitch replacement

The procedure here after described, allows to replace one of the microswitches used as rotation start / stop references.

1. After having gained access to the rotation group, locate the failed microswitch and take notice of its current position, for example marking a reference point on its support.
2. Remove the failed component and place the new microswitch in a position as equivalent as possible to the old one, using the reference mark done in step 1.
3. Using a DVM in V reading, full scale 10V, position its terminal between pins 2 and 3 (see next Figure) of the rotation potmeter R2.



4. Turn ON the device and wait for the end of the initial self-test.
5. If the replaced micro is the START micro, go to the next step; if the replaced micro is the STOP micro go to step 11.
6. Press "**R**" key (32; Reset); the arm will rotate up to reach the 0° position.
7. Read the value of the potmeter voltage on the DVM: if the value is between 160mV and 180mV the position of the micro is already correct and proceed to step 16; if it is outside the range move to next step.
8. Press "**T**" key to move away the arm of an angle between 45° and 90°.
9. If the reading of the potmeter voltage of step 7 was below the lower limit of the range, move the microswitch so that the arm will reach it earlier than in the previous position; on the contrary if the reading of the potmeter voltage of step 7 was over the upper limit of the range, move the microswitch so that the arm will reach it later than in the previous position. To move the microswitch release the plate supporting it and adjust its position.
10. This procedure is a trial and error process: repeat steps 6 to 9 until the reading of the potmeter voltage with the arm in 0° position is between 160mV and 180mV.
11. This step applies if the replaced micro is the STOP one. Press "**R**" key (32; Reset); the arm will rotate up to reach the 0° position; then press "**T**" key keeping it pressed until the arm reaches the final position hitting the STOP microswitch.

12. Read the value of the potmeter voltage on the DVM: if the value is between 2.00V and 2.30V the position of the micro is already correct and proceed to step 16; if it is outside the range move to next step.

13. Press "**R**" key (32; Reset) to move away the arm which will go back to 0° position

14. If the reading of the potmeter voltage of step 12 was below the lower limit of the range, move the microswitch so that the arm will reach it later than in the previous position; on the contrary if the reading of the potmeter voltage of step 12 was over the upper limit of the range, move the microswitch so that the arm will reach it earlier than in the previous position. To move the microswitch release the plate supporting it and adjust its position.

15. This procedure is a trial and error process: repeat steps 11 to 14 until the reading of the potmeter voltage with the arm in 245° (STOP) position is between 2.00V to 2.30V.

16. Run the procedure to verify centering and symmetry of the panoramic, making an exposure on the round centering tool as described in paragraph 7.7.4.

17. On the basis of the values determined for the PAN adult (A2, A3, A4, A5) set the value of the angles A2 and A5 for child as follows:

- A2 child = A2 adult +9°
- A5 child = A5 adult -9°

18. Run a PAN child on the same centering tool and verify the symmetry of the image; if necessary fine-tune the angles.

19. If the values determined in step 16 and 17 are different from those reported in the Appendix of the "Final Test Table" present at the end of the User's Manual, report the new current values in the same table.

WARNING:
DURING INSTALLATION, IT IS RECOMMENDED TO RECHECK THE LINE VOLTAGE AND TUBE CURRENT AS DESCRIBED IN THE FOLLOWING PARAGRAPHS.

7.3 Checking and adjusting the AC voltage

1. Access the set-up program (refer to paragraph 7.2), then press **“s”** (39) and "**T**" (31) several times until the S3 function is displayed. Change the status of S3 to ON by pressing "**s**" (39).
2. Press "**R**" (32). The remote control display will show the voltage value.
3. Connect a true RMS value digital voltmeter to the terminals "L" and "N" (input) and read the AC voltage value.
4. If the values read at previous point "2" differ of more than ±1V from the one read at point "3", act on trimmer R85 of board A2 in order to obtain the matching of the two readings.
5. To return to the normal working condition, press "**T**" (31).

7.3.1 Check of line voltage regulation

WARNING:
The following test implies X-ray emission; please follow all measures envisaged by local safety regulations.

The system is qualified to operate with a maximum line voltage regulation of 3% at 108V, which is the line voltage generating the highest current draw from the line.

Check of line regulation: a proper installation has to make sure that the line provided in the facility where the device is being installed, meets the requirement of line voltage regulation. In order to carry out this test proceed as follows:

1. Using a true RMS Voltmeter asses the line voltage value under no load condition (Vn).
2. Select a timer setting of 2 seconds and make an exposure.
3. Using the same RMS Voltmeter, read the line voltage during exposure which is the under load condition (Vi).
4. Calculate line voltage regulation as: ((Vn-Vi)/Vi)x100. To make absolutely sure that the line meets the requirement independently from possible drift of the line voltage during life of the equipment the measured line voltage regulation must be smaller than 2.4%.
5. In case line voltage regulation does not meet the spec, refer to paragraph 5.1 of this manual and consult with a certified electrician or the local Power Company.

7.4 Checking the output current (mA)

WARNING:
The followings tests (7.4.1 and 7.4.2) implies X-ray emission; please follow all measures envisaged by local safety regulations.

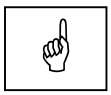
NOTE:
The output current can be checked both with the arm rotating or in stopped. Hereafter the two different methods are described.

7.4.1 First solution (rotating arm in movement)

1. Verify that the display show 75kV, in the other case use the "decrease" key (40) or "increase" key (41) of the hand control to change the value to 75kV.
2. Connect the probes of a DVM in VDC, full scale 20V, in the TEST mA plugs of A1 board or to pins 5-6 of X9 on the same board. This allows to measure voltage drop on resistor 1K – 0.5W generates by the flow of anodic current through it (1V equals 1mA).
3. Move the S1 switch of board A1 toward the test points.
4. Press the X-ray button and check that the voltage is 10V ± 1V. If not, adjust the R2 resistor collar of board A1; moving the cursor to the top, the anodic current value will increase, moving to the bottom will decrease. Once the regulation is complete, tighten the screw on the resistor collar.
5. After the adjustment, set the S1 switch back to its initial position.

7.4.2 Second solution (rotating arm blocked)

1. Access the set-up program (see paragraph 7.2), then press **“s”** (39) and "**T**" (31) several times until the S4 function is displayed. Change the status of S4 to ON by pressing "**s**" (39).
2. Press "**R**" (32) to display 85kV. Use the "decrease" key (40) to change such value to 75kV.
3. Connect the probes of a DVM in VDC, full scale 20V, in the TEST mA plugs of A1 board or to pins 5-6 of X9 on the same board. This allows to measure voltage drop on resistor 1K – 0.5W generates by the flow of anodic current through it (1V equals 1mA).
4. Move the S1 switch of the board toward the test points.
5. Press the X-ray button and check that the voltage is 10V ± 1V. If not, adjust the R2 resistor collar of the board A1; moving the cursor to the top, the anodic current value will increase, moving to the bottom will decrease. Once the regulation is complete, tighten the screw on the resistor collar.



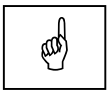
NOTE:
The arm can be rotated to the desired position by pushing the **“T”** (31) button. When the arm reaches the position, push the X-ray button (42).

6. After the adjustment, set the S1 switch back to its initial position.
7. To return to the normal working condition, access the set-up programs and change S4 back to OFF.
8. Switch OFF the unit, switch it back ON, activate set-program (see paragraph 7.2), press **“s”** (39) then "**T**" (31) several times until reading S4 ON. Press **“s”** (39) to change S4 to OFF.

7.5 Checking and centering adjustment of the X-ray beam

ROTOGRAPH-D does not usually require adjustment of the X-ray beam. However, if necessary, follow the instructions provided in the next paragraph to adjust the X-ray beam.

WARNING:
The followings test implies X-ray emission; please follow all measures envisaged by local safety regulations.



NOTE:
At the end of the check and adjustment, record the serial number of each diaphragms checked with the system onto the "Final Test Table" (see the last page of the User's Manual).

7.5.1 Alignment of the X-ray beam for the PANORAMIC mode

To check alignment of the X-ray beam in the Panoramic mode proceed as follows:

1. Install a fluorescent screen 101 (P/N 61089101) on the Digital Sensor protection shield and tape it.

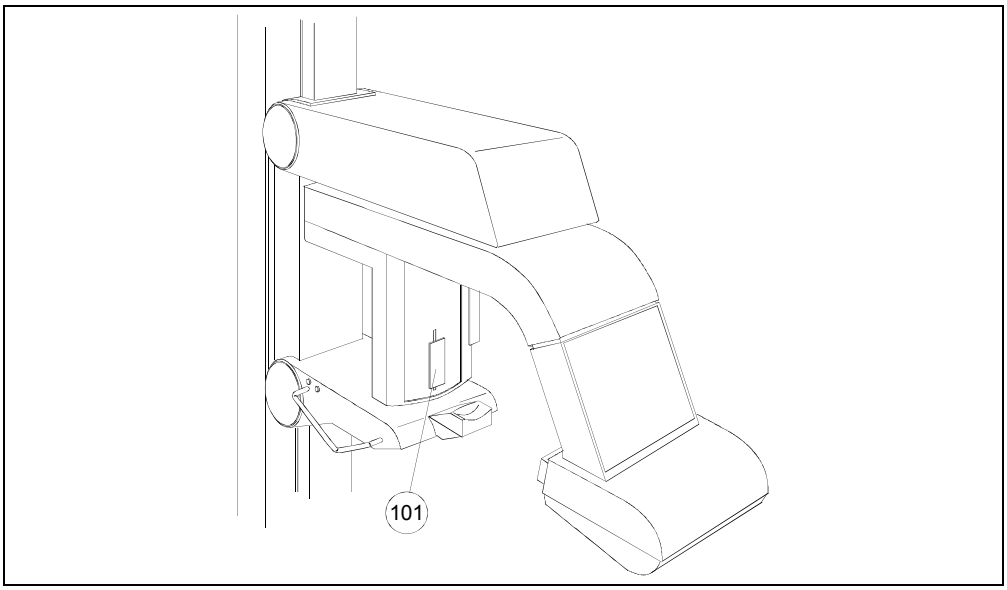


Figure 7-2

2. Set S4 in ON (see paragraph 7.2.2) and move the rotating arm, by means of the "**T**" test button, until reaching an arm position that allows to see the fluorescent screen standing in a protected area from the X-ray beam.

3. Make an exposure by depressing the X-ray emission button (42) and check the geometrical alignment of the visible beam and the slit aperture in the shield assembly.

7.5.1.1 Oblique regulation

If the X-ray beam is not aligned with the sensor in oblique direction, the front cover "106" of the tube head must be removed, release grubs "107" positioned on both sides of the metal support of the collimator and rotate the support itself in such a way to correct the alignment; screw in the grubs.
Check again the alignment and repeat it if necessary.
At the end mount back the frontal cover of the tube head

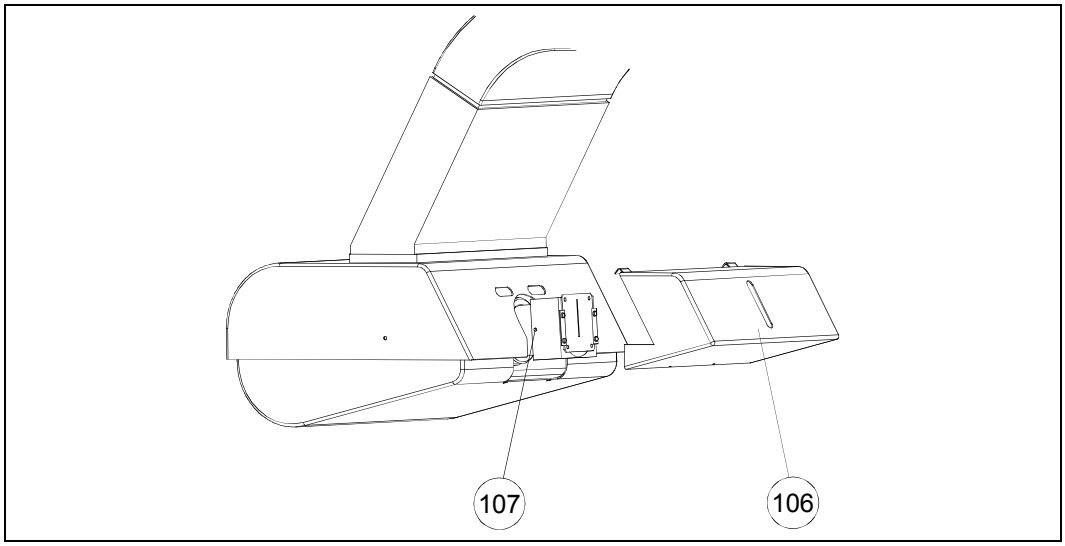


Figure 7-3

7.5.1.2 Vertical regulation

If the X-ray beam is not aligned with the sensor along the vertical direction, the front cover "106" of the tube head must be removed, release the four screws "122" supporting the lead of the collimator; move the lead upward or downward to correct the problem and tight again the 4 screws.
Check the alignment once more and repeat the procedure if necessary
At the end mount back the frontal cover of the tube head

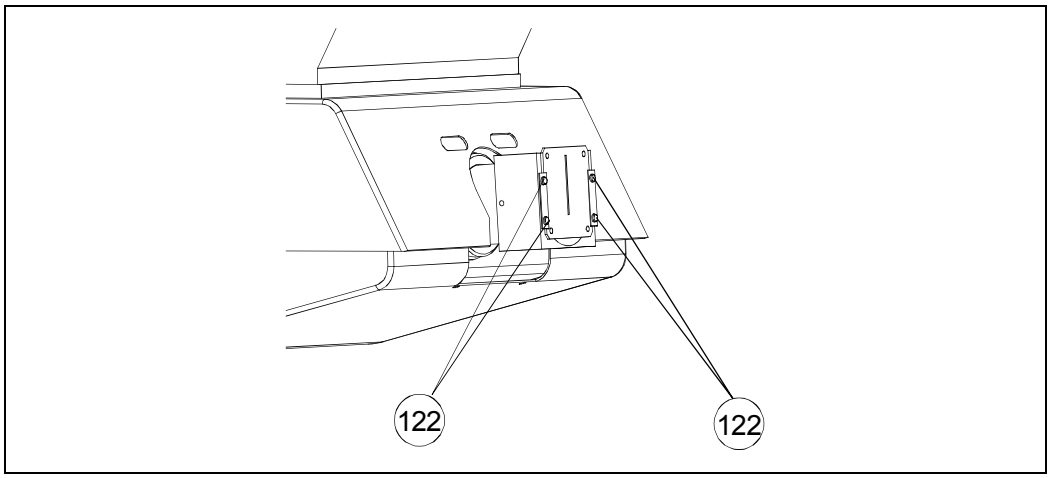


Figure 7-4

7.5.1.3 Horizontal regulation

If the X-ray beam is not aligned with the sensor along the horizontal direction, the cover of the arm supporting the tube head has to be removed, release the 2 screws "104" and rotate the tube head in order to align the X-ray beam with the fluorescent screen; screw back the 2 screws.

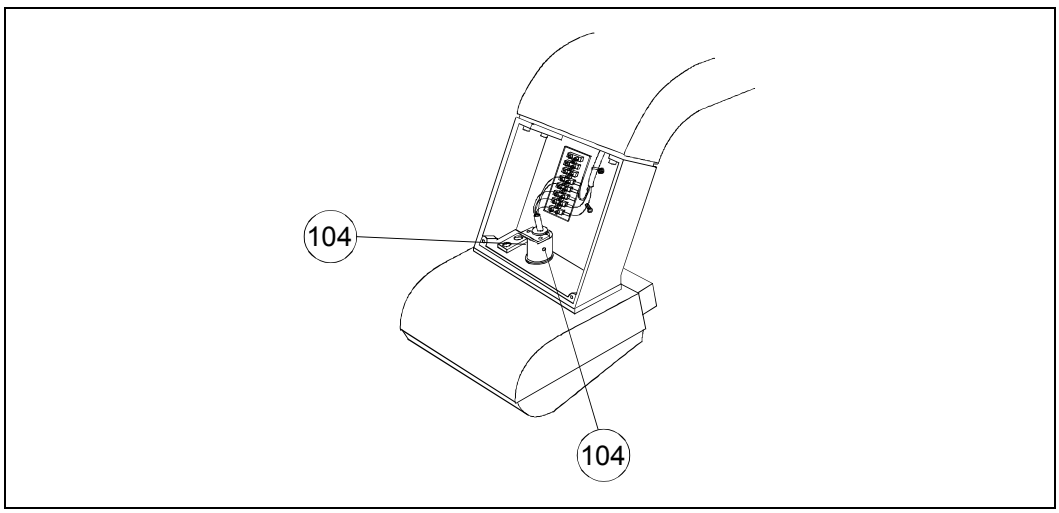
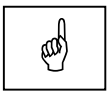


Figure 7-5

7.6 Angle (A...) and Time (T...) control

Enter the set-up procedure as described in the paragraph 7.2, up to the password input. Once the "S5" switch is set to on, press "**R**" button (32) to exit from the function; there is no needs to have the rotating arm moved. Press "**T**" (31) e release it immediately to display "T1 020" (heating time, cannot be changed) corresponding to a value of 2 seconds. Now you can press and release in succession the "**s**" button (39) to display information concerning the different angles and times. To change the values, please refer to paragraph 7.7.
Meaning of each angle (A...) and time (T...), depending on the examination selected, as follows.



NOTE:
The values indicated after the angular references (A1÷A6) must match those recorded in the "Final Test Table" (see the last page of the User's Manual) supplied with the equipment and filled in during the factory test.
If for any reason these values are changed, the new values must be written in the table mentioned above.

- **Pan function (27), Adult-Child (33 or 34)**

T1:	Heating time of filament	(cannot be changed)
A1:	Displayed but not used (A1 000)	(cannot be changed)
A2:	X-ray emission start angle	(can be changed)
A3:	Arm motor deceleration ramp start angle	(can be changed)
A4:	Arm motor acceleration ramp end angle	(can be changed)
A5:	X-ray emission end angle	(can be changed)
T2:	Arm rotation time	(cannot be changed)
T3:	Actual X-ray emission time	(cannot be changed)

- **TMJ1 function (29), Adult-Child (33 or 34)**

T1:	Heating time of filament	(cannot be changed)
A1:	X-ray emission start angle I° exposure	(can be changed)
A2:	X-ray emission end angle I° exposure	(can be changed)
A5:	X-ray emission start angle IV° exposure	(can be changed)
A6:	X-ray emission end angle IV° exposure	(can be changed)
T2:	Arm rotation time	(cannot be changed)
T3:	Actual X-ray emission time (I°+IV° exp.)	(cannot be changed)

- **TMJ2 function (30), Adult-Child (33 or 34)**

  T1: Heating time of filament (cannot be changed)
  A1: X-ray emission start angle II° exposure (can be changed)
  A2: X-ray emission end angle II° exposure (can be changed)
  A3: K20 relay closing angle (can be changed, but is insignificant)
  A4: K20 relay opening angle (can be changed, but is insignificant)
  A5: X-ray emission start angle III° exposure (can be changed)
  A6: X-ray emission end angle III° exposure (can be changed)
  T2: Arm rotation time (cannot be changed)
  T3: Actual X-ray emission time (II°+III° exp.) (cannot be changed)

7.7 Changing angles and times

The S5 function allows to change the default angles and times for any function and size. In particular, you can change the X-ray emission start (A2) or end (A5) angles, the deceleration (A3) or acceleration (A4) ramp start angles or the duration of the four TMJ exposures by simply using the procedure here after described for the parameters you want to change.

For all the following procedures hereafter described, entering the set-up program is required (see paragraph 7.2), then press **“s”** (39) followed by **“T”** (31) several times until the function **“S5 ……”** is displayed and press **“s”** key to set **“S5 ON”** (see paragraph 7.2.2, function "S5" for further details).

NOTE:
Press "**R**" (32) to exit the S5 function. This will not set automatically function S5 to OFF (S5 OFF) and after an exposure the string "**T1 020**" will be displayed.

To access the normal working function again, return to the set-up program and change S5 to OFF.

NOTE:
Every change must be carried out by pressing the "increase" (41) and "decrease" (40) keys.

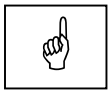
7.7.1 PAN-ADULT

1. Select the Pan function (27) and Adult size (33) on the remote control.

2. Press "**T**" (31) and release it immediately to display "T 020" (heating time, cannot be changed).

3. Press "**s**" (39). The string "A1 000" will be displayed (not used and not modifiable).

4. Press "**s**" (39) to display the string "A2 ....." (X-ray emission start angle), followed by a variable value which can be adjusted from 3° (003.0) to 6° (006.00).
   This procedure allows for the ability to "increase" or "decrease" the width of the white (not exposed) band on the left side of the pan exposure shot. Such variation must be carried out by means of the "increase" (41) or "decrease" (40) keys.

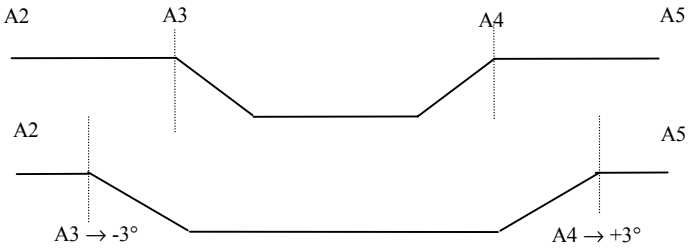


NOTE:
Before switching from one adjustment to the next, you will have to confirm the new setting by pressing the "T" key (31).

5. Press "**s**" (39) to display the string "A3 ....." (motor deceleration ramp end angle in the central area). This setting determines the starting point of the rotation speed change (slowdown) which can be modified by a max of ± 3° with respect to the value indicated in the “Final Test Table” (see the last page of the User’s Manual).
   Reducing the value will anticipate the rotation’s slow down area; this will increase the area where the spine compensation will take effect.

6. Press "**s**" (39) to display the string "A4 ....." (motor acceleration ramp end angle in the central area). This setting determines the starting point of the rotation speed change (ramp up) which can be modified of max ± 3° with respect to the value indicated in the “Final Test table”.

NOTE:
If you change one of the two values (A3) or (A4), it is recommended to change also the other one of a corresponding opposite amount so as to obtain a symmetrical exposure (see following diagram).



7. Press "s" (39) to display the string "A5 ....." (X-ray emission end angle). This setting determines the end of emission which can be modified of max of 2° with respect to the value indicated in the “Final Test Table”.
This function will be used, for instance, in case of a anticipated stop of X-ray emission that will cut the left condile.

NOTE:
To modify the darkening effect on the central area, change the V2 speed by using the R40 trimmer of the A1 board.
To increase the darkening effect, decrease the motor speed by adjusting the trimmer counterclockwise. To decrease the darkening effect, adjust it clockwise.
Before adjusting the V2 voltage, you must read the voltage on the TP4 (+) and TP3 (-) Test Points of the A1 power board and compare it to the one indicated on the “Final Test table”. Now you may alter the voltage, remembering that the value read cannot be changed of more than 1V.

V2 must always be lower than V1 of 3V ±0.2V.
The R45 trimmer for the adjustment of the slope of the deceleration ramp (deceleration from V1 to V2) located on the A1 board is calibrated at the factory (3V/sec) and should not be adjusted on site.

7.7.2 PAN-CHILD

In the Pan (27), Child (34) function, the possible adjustments are similar to those described for the Adult size, but the central area deceleration function is disabled and the activation of such function is not permitted.

Also, the value of the string "A2 ....." (X-ray emission start angle) can be changed from 14° (014.0) to 17° (017.0).

7.7.3 TMJ1 and TMJ2 - ADULT and CHILD

WARNING:
IN THE EVENT THAT THE CONDYLE SHOULD NOT BE AT THE CENTER OF THE IMAGE DURING THE TMJ2 PHASE (EXPOSURE WITH OPEN MOUTH), THE PROBLEM IS BE DUE TO A BAD POSITION OF THE PATIENT, NOT TO THE SIZE OF THE BANDS.

TMJ1

1. Select the TMJ1 function (29) and adult (33) or child (34) size on the remote control.
2. Press "**T**" (31) and release it immediately to display "T 020" (heating time, cannot be changed) corresponding to 2 seconds.
3. Press "**s**" (39) to display the string "**A1 .....**" (X-ray emission start angle, 1st exposure). This setting can be modified of max ±2° with respect to the value indicated in the “Final Test Table” (see the last page of the User’s Manual).
4. Press "**s**" (39) to display the string "**A2 .....**" (X-ray emission end angle, 1st exposure). This setting can be modified of max ±2° with respect to the value indicated in the “Final Test table”.
5. Press "**s**" (39) to display the string "**A5 .....**" (X-ray emission start angle, 4th exposure). This setting can be modified of max ±2° with respect to the value indicated in the “Final Test Table”.
6. Press "**s**" (39) to display the string "**A6 .....**" (X-ray emission end angle, 4th exposure). This setting can be modified of max ±2° with respect to the value indicated in the “Final test table”.

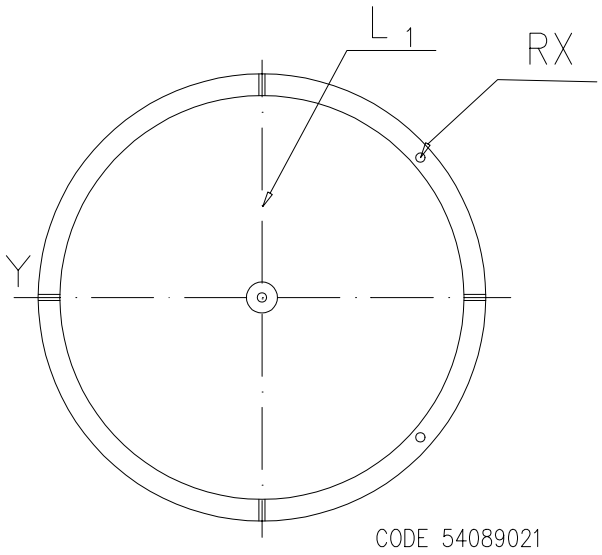
TMJ2

To switch from TMJ1 to TMJ2 data control, use the "R" button, select the TMJ2 function and bring the cassette tray from the Pan/TMJ1 position to the TMJ2 position by turning the reeded handle 13 (see Figure 7-6) counter clockwise.

1. Press "**T**" (31) and release it immediately to display "T 020" (heating time, cannot be changed) corresponding to 2 seconds.
2. Press "**s**" (39) to display the string "**A1 .....**" (X-ray emission start angle, 2nd exposure). This setting can be modified of max ±2° with respect to the value indicated in the “Final Test Table” (see the last page of the User’s Manual).
3. Press "**s**" (39) to display the string "**A2 .....**" (X-ray emission end angle, 2nd exposure). This setting can be modified of max ±2° with respect to the value indicated in the “Final test Table”.
4. Press "**s**" (39) to display the string "**A3 .....**" (modifiable but insignificant).
5. Press "**s**" (39) to display the string "**A4 .....**" (modifiable but insignificant).
6. Press "**s**" (39) to display the string "**A5 .....**" (X-ray emission start angle, 3rd exposure). This setting can be modified of max ±2° with respect to the value indicated in the “Final Test Table”.
7. Press "**s**" (39) to display the string "**A6 .....**" (X-ray emission end angle, 3rd exposure). This setting can be modified of max ±2° with respect to the value indicated in the “Final test Table”.

7.7.4 Verification of Panoramic centering and symmetry

1. Place the centering tool (P/N 54089021) on the chin rest and a filter of about 12 mm Al on the window in front of the sensor.



2. Make an exposure in Adult mode at 85 kV, acquired by the ProImage program.
3. Set contrast and brightness level to have good visibility of all centering balls.
4. Pressing the key in the upper –right region of the instruments box for image processing, it is possible to view the image in the scale 1:1 which facilitates the next steps.
5. Using the dedicated cursors, position the image to see the balls of the left side.
6. Select the instrument which measures distance and position the cursor on the center of the ball on the left of the image.
7. Click on the right button of the mouse and keeping it pressed, drag the pointer to the center of the central ball. Releasing the button, in the image shows up, it is possible to read the distance, which must be in the range 460.
   In the measuring window the number of pixel measured is also reported and this measurement is more sensitive, so this is a preferred method.
8. Repeat the measurement on the right side of the image.
9. Check that the new measure does not differ from the previous one by more than 1 mm or 11 pixel.

10. Make a measurement also of the distance between the right and left ball: it must be inside the range 89 ± 1 mm.

11. If this is not met, access the set up procedure and modify all angles **A2÷A5 of the same amount (in steps of 0.5°) in the following way:**

- if the measurement of the left side is greater than the right side, increase the angles
- if the measurement of the left side is smaller than the right side, decrease the angles.

7.8 Message on the display of remote control

ROTOGRAPH-D is entirely run by a microprocessor that, besides setting the exposure parameters and correcting the main voltage fluctuation, signals by mean of messages on the display the different conditions of the system and the eventual anomalies and procedural mistake.
The first of the following tables indicates the usual operational messages while the second indicates all failure messages which require prompt intervention of the Technical Assistance Service.

Message displayed	Cause	What to do
Minimum	The lowest limit of the range allowed by the control button 40 was reached	Select a correct value
Maximum	the highest limit of the range allowed by the control button 41 was reached	Select a correct value
Wait, please.....	A X-ray exposure has been performed. Wait for the cooling time of tube head	Wait 4 minutes in case of PAN or TMJ exposure and 1 minutes in case of CEPH
Equipment not set	Not all interlocks are enabled	Press a second time the function button selected to verify the interlock to enable
Digital Sensor Not ready	Digital sensor not enabled	Request activation of digital sensor by the QuickVision program
Select PAN/TMJ1	Functionality of the digital sensor has not been selected	Select functionality of the sensor activating one of the buttons on the cover of the digital sensor
Select TMJ2	The sensor is not activated for TMJ2 after having selected this test on the hand control	Select functionality TMJ2 of the sensor activating the button **15** on the cover of the digital sensor
Push "RESET"	A PAN or TMJ modality was either completed or interrupted	Press the RESET button 32
OK	The arm return run is completed	Release button RESET 32

Alarm

Message displayed	Cause	What to do
Line voltage too high	**See paragraph 7.8.1**	
Line voltage too low	**See paragraph 7.8.1**	
Impossible to regulate the line voltage	**See paragraph 7.8.2**	
Memory data corrupted! Call Technical Assistance	**See paragraph 7.8.3**	
NO ANSWR	**See paragraph 7.8.4**	
Out of Order N° 1 ! Call Technical Assistance	**See paragraph 7.8.5**	

7.8.1 Line voltage too high / too low

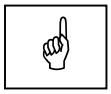
This message indicate that the line voltage is below –10% or above +10% with respect to the nominal value.

Check first the line voltage using a normal calibrated DVM. If the line voltage is indeed outside the specified range of ±10% with respect to the nominal value, ask the power supply company to make sure that the proper line voltage is supplied.

If the voltage is correct, check that line voltage is read correctly by the device (reference paragraph 7.3).

In case the calibration of the line voltage is not possible and the message is "Line voltage too low", make the following checks:

- check that fuse F3 (1AT) of CPU board (A2) is not broken; replace it if this is the case
- check that connector X10 on Power board (A1) is properly inserted and not damaged; if needed replace it.



NOTE:
DENT-X is not responsible of making sure that the supplied line voltage is within the specified range.

7.8.2 Impossible to regulate the line voltage

This message is caused by too large line fluctuation during the preheating time after having pressed the X-ray button.

Check that the line voltage does not vary more than 2.5V during a period of a couple of seconds: if this is the case is necessary to stabilize the line voltage.

If line voltage is stable, but the message is displayed:

- check that line voltage is read correctly by the device (reference paragraph 7.3)
- check connections between CPU (A2) board and Power board (A1); replace cables and/or connectors X16 and X17 as needed.

WARNING:
The following test implies X-ray emission; please follow all measures envisaged by local safety regulations.

- during the preheating time check that some of the relays from K1 to K10 of the Power board used to compensate for line voltage value, change their status; if this does not happen it is possible that the relais network is failed and in this case replace the board.

7.8.3 Memory data corrupted. Call Technical Assistance

With the system on and this failure message displayed operate in sequence on the small size push button (37), child (34) and TMJ1 (29) (as per the SET-UP mode) wait 5 sec.: the operating condition should be restored.
Should, after 5 seconds, the situation not be restored replace the CPU (A2) PCB and thereafter proceed to the system general checking.

WARNING:
In any case, the factory and/or custom parameters are lost. Proceed to insert all data, according to the one recorded on the "Final Test Table" (see the last page of the User's Manual) as described on the Set-up procedure (see paragraph 7.2 and following).

7.8.4 "NO ANSWR"

This message can be read in three different circumstances following the ignition phase of the system.

In the first case it can be read during the phase of the CPU A2 PCB CHECK CONTROL (which is automatic during the system ignition phase) and is tested by the lighting of LED H1 located between the components D7 and D9 of the PCB itself; proceed in this case to replace the CPU (A2) PCB and then proceed with the system general checking.
In the second case, the message can be read during the hand control CHECK CONTROL phase (automatic as above); proceed in this case to replace the hand control and then proceed with the system general checking.
In the third case, the message can be read if transmission protocol has failed and then no exchange of information between the hand control and the CPU (A2) PCB is active.
Check, then, that the two female connectors of the coiled telephone cable are well connected to the hand control and to the CPU PCB and that there is continuity at the cable ends.
Should these checks have a negative result, replace the hand control or the CPU PCB in order to identify the origin of the failure.
After having replaced one of the two components proceed with the system general checking.

7.8.5 Out of Order N°1! Call Technical Assistance

This message can be displayed on two different conditions, due to a fault of the potentiometer used to control angular position of the rotating arm.

This message can be caused by a failure of the potentiometer or a bad contact in the harness between the potentiometer and the control circuit (see chapter 9 – General diagram code 39099327 – Page 4 of 5).

Another possible cause is the failure of one of the start/stop rotation microswitch S2/S3 (see Figure 7-1). Check the microswitch and/or harness.

7.9 Checking (safety) hardware timers

WARNING:
The following test implies X-ray emission; please follow all measures envisaged by local safety regulations.

1. Enter the SET-UP program (see paragraph 7.2). Then press "**s**" (39), then button "**T**" (31) several times until reaching S4 mode; set S4 to ON by pressing "**s**" (39).
2. Press button "**R**" (32)to exit the S4 function and read on the display the time set in Panoramic.
   To see the time set in Cephalometry operate on push button decreasing (40).

If the hardware safety timers need to be checked by external means, proceed as follows:

3. By means of the "decrease" (40) or "increase" (41) push button, increase to a value higher than the Hardware timer preset value of the mode to be checked. Remember that the safety Hardware time set for Panoramic is 20 sec. while that for Cephalometry is of 5 sec.
4. Perform an exposure, measuring the time of activation relay K21 pilot light.
   Should this time be different of more than 2 sec. than the one recorded at point "2" adjust on trimmer R87 for the Panoramic time and trimmer R86 for the Cephalometry time.

When the adjustment is over, proceed as follows:

5. Turn the system OFF. Turn it ON again. Enter in SET-UP and set S4 to OFF.
   To return to the normal working conditions, press button "**R**" (32).

7.10 System reconfiguration after testing's

After checking the various modes, set them (SO-SA) in the starting conditions, i.e. in the conditions reported in the "Final Test Table" (see the last page of the User's Manual), with the exception of those modes whose modifications are considered to be necessary.

In case of changes respect to the values reported on the User's manual, the new values have to be written on the above mentioned table, in order to assure traceability of these values in case of data corruption and/or hand control replacement. These values have to be written by the technical personnel, together with the date of change.

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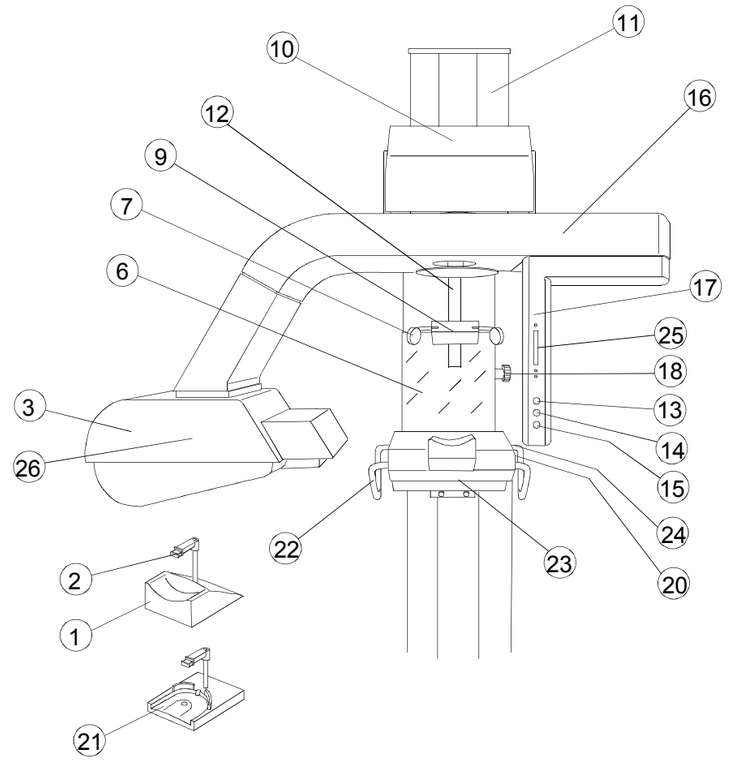


Figure 7-6: Stand

1	"PANORAMIC" chin support	**15**	TMJ2 selection button
2	Bite Block	**16**	Rotating arm
3	Tube head	**17**	Digital Sensor
6	Centering mirror	**18**	Horizontal light beam height control knob
7	Skull / Temple clamp support	**20**	Light cross beam button
9	Skull / Temple clamp control knob	**21**	Chin support TMJ, SINUS. Also used as an accessory to raise children's chin by sandwiching it with the standard Panoramic chin support
10	Motor group unit	**22**	Patient positioning handle and slider
11	Column	**23**	Support unit of the motor group
12	Slider	**24**	Brake release button
13	PAN selection button	**25**	Slot for Memory Card
14	TMJ1 selection button	**26**	Focus position point

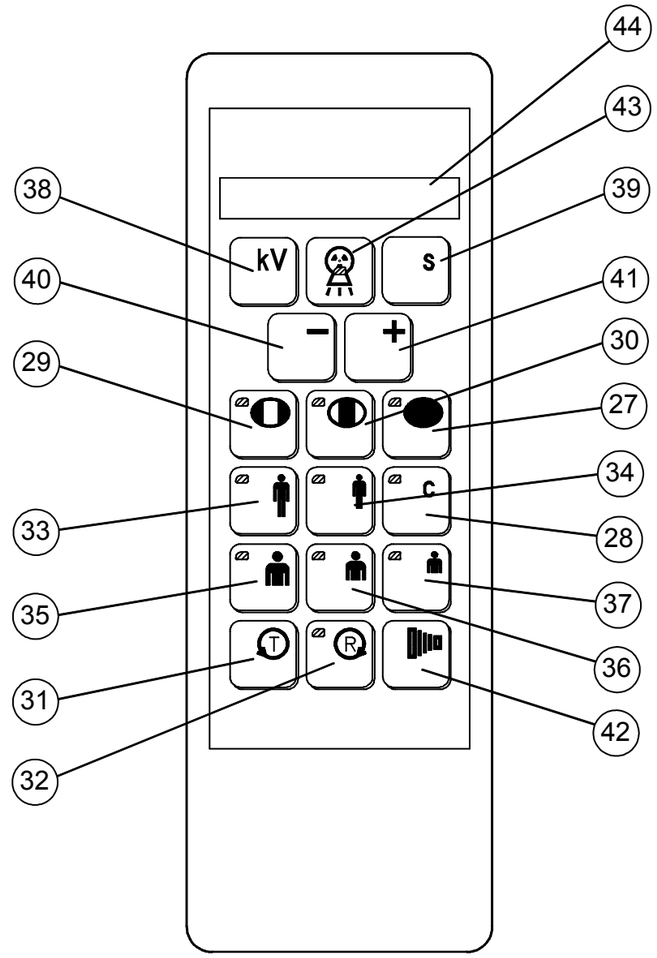


Figure 7-7: Remote control

27 PAN mode Selection
28 NOT ENABLED
29 TMJ1 mode Selection
30 TMJ2 mode Selection
31 Test mode ("dead man" button)
32 RESET ("dead man" button)
33 Adult Selection
34 Child Selection
35 Large Size Selection
36 Medium Size Selection
37 Small Size Selection
38 kV Selection
39 Push-button Multifunctional
40 Decrease kV
41 Increase kV
42 X-rays push-button ("dead man" button)
43 X-rays emission pilot LED
44 Alphanumeric display

8. MAINTENANCE

As for all the devices, in addition to proper use this unit also requires periodical checks and maintenance. These precautions will insure a safe and efficient performance of the device.

The preventive maintenance consists of checks that can be carried out directly by the operator or by the authorized service personnel.

The checks that can be carried out directly by the operator are the following:

Interval	Type of check
Daily	- check that the tube head does not have oil leakage - check that the cable of the remote control is not damaged - check that the unit does not show damages that may affect the protection against radiation - check that no metallic noise are generated by the column or the rotating assembly.
Once a week	- check that the metal ropes of the column are not damaged or broken (the ropes can be seen on the side of the column) - while performing exposure, release the X-ray push button and check that the beeper stops beeping immediately.
Every 6 months	- check that the label are not damaged and well attached.

In addition to the above checks (to be performed by the operator), checking to be performed by the Service Engineer are described in the following table.

Interval	Type of check	Ref. and method
Every 6 months	Check of display function	Visual check
	Check the centering of the X-ray beam	See paragraph 7.5
	Verification of centering and symmetry of panoramic	See paragraph 7.7.4
	Check the mA setting (after 400 exposures)	See paragraph 7.4
	Check to ensure that no oil is leakage from the tube head	Visual inspection
	Check that the certification and identification labels are firmly fixed on the tube head, control box and CEPH arm	Visual inspection
Once a year	Check the hardware safety timers	See paragraph 7.9
	Check the tension of the chains and belts and adjust if necessary	Practical inspection
	Clean and lubricate all the carriage guides	Practical inspection
	Check full steel cable integrity	Visual inspection

9. SCHEMATICS AND DRAWINGS

1. Control Box layout
2. General diagram
3. Layout Power Supply PCB A1
4. Circuit diagram Power Supply PCB A1
5. Layout Speed Control PCB A7
6. Circuit diagram Speed Control PCB A7
7. Layout CPU PCB A2
8. Circuit diagram CPU PCB A2
9. Layout Remote Control PCB
10. Circuit diagram Remote Control PCB

9.1 Key to general diagram of the Rotograph-D

A1 Power Supply P.C.Board
A2 CPU P.C.Board
A3 Interconnecting P.C.Board
A4 Remote control P.C.Board
A5 Hand control P.C.Board
A6 Sensor P.C.Board

F1 Fuse 10 A T
F2 Fuse 1 A T
F4 Fuse 0.315 A F of Power Supply PCB

H12 Lamp mains ON (switch S9)
H13 Cross centering light

M1 Arm rotation motor

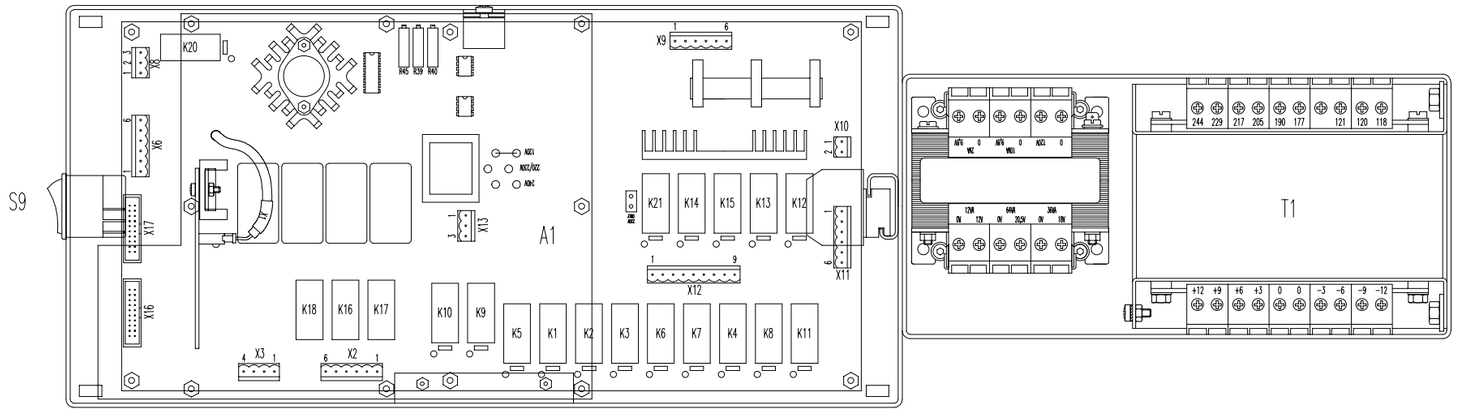
R2 Potentiometer for angular control (assembly)

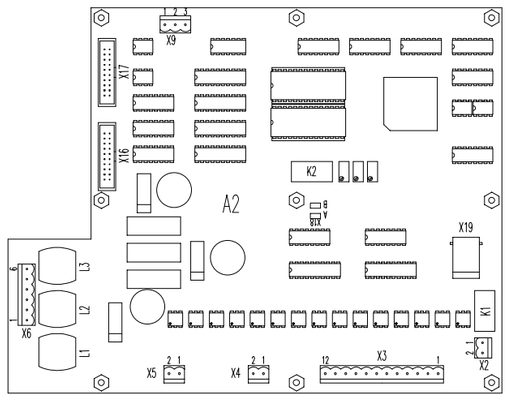
S2 Arm return stop microswitch
S3 Arm advance stop microswitch
S9 Main switch (DPDT type)
S13 Brake switch right
S15 Cross beam light switch

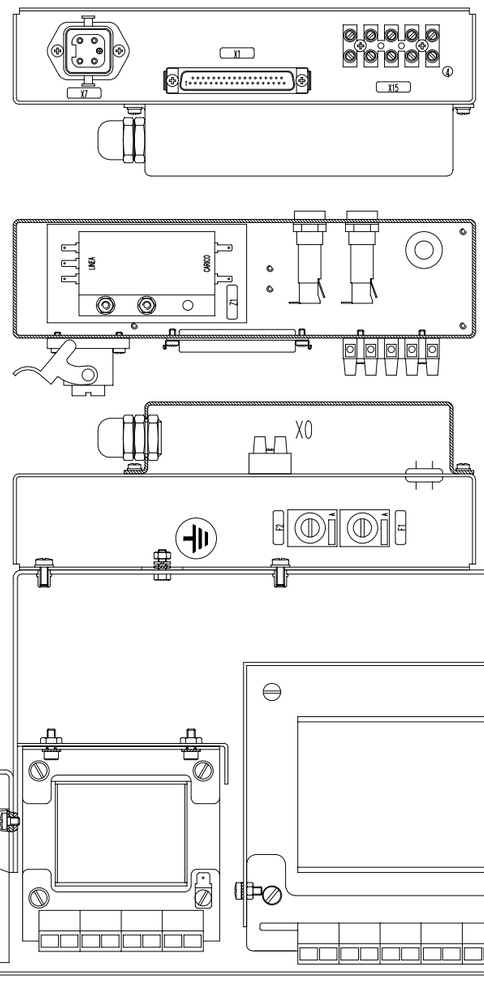
T1 Autotransformer 800 VA
T2 Transformer single phase 124 VA

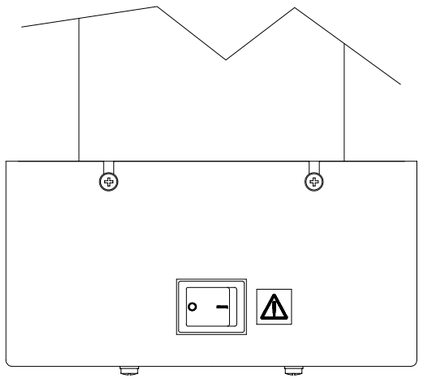
Y1 Vertical movement brake

Z1 Filter 6.5A – 250V

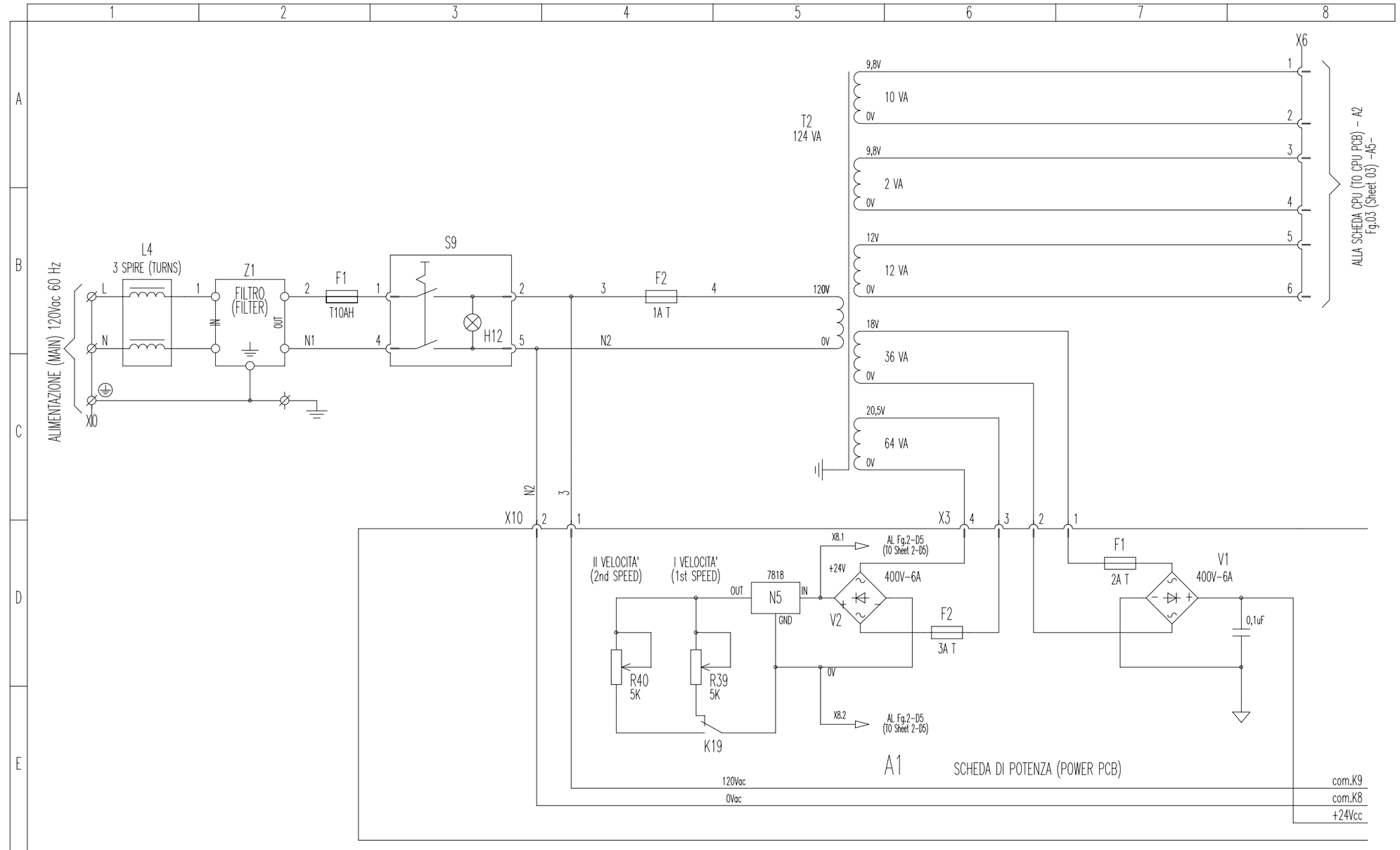




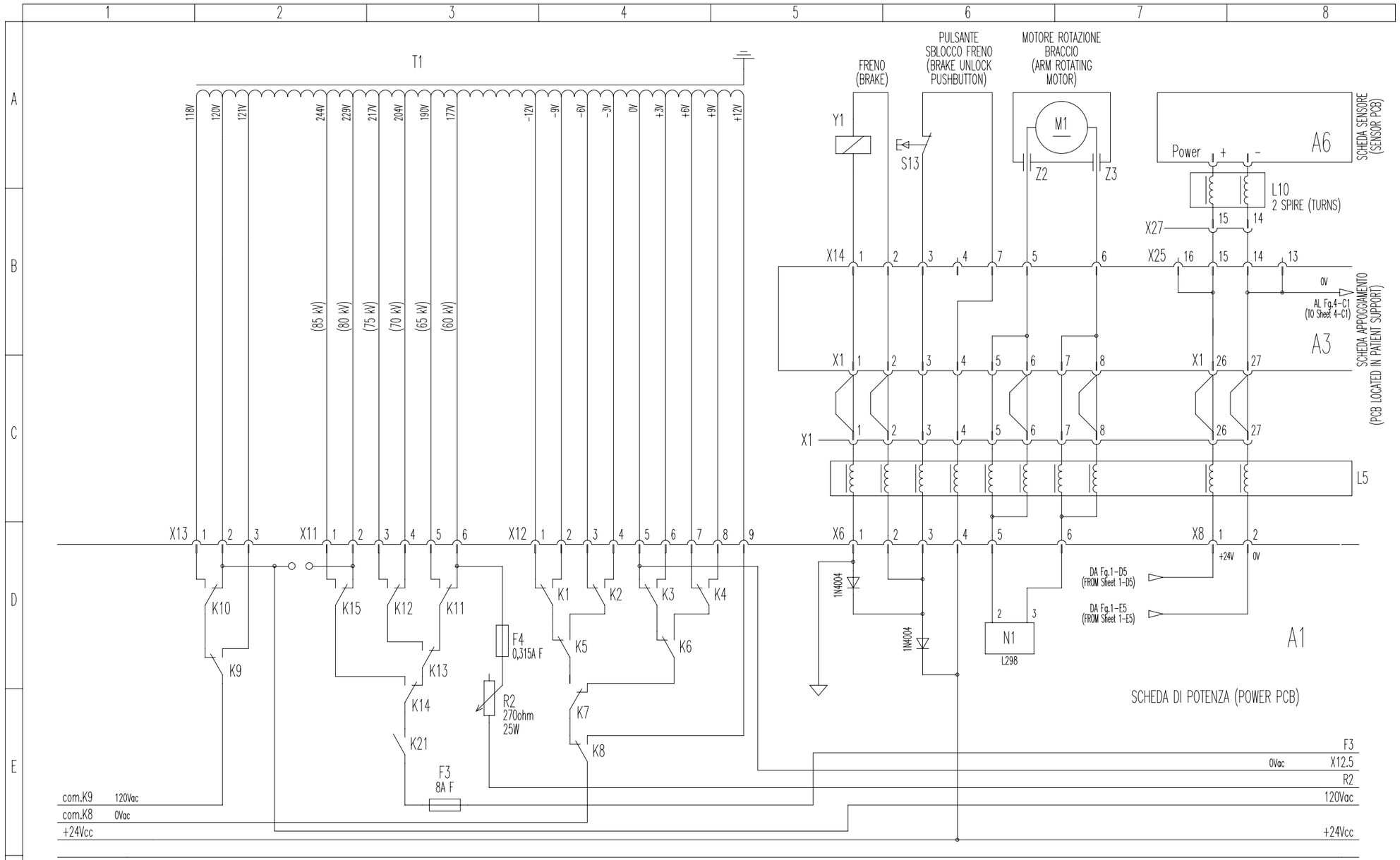




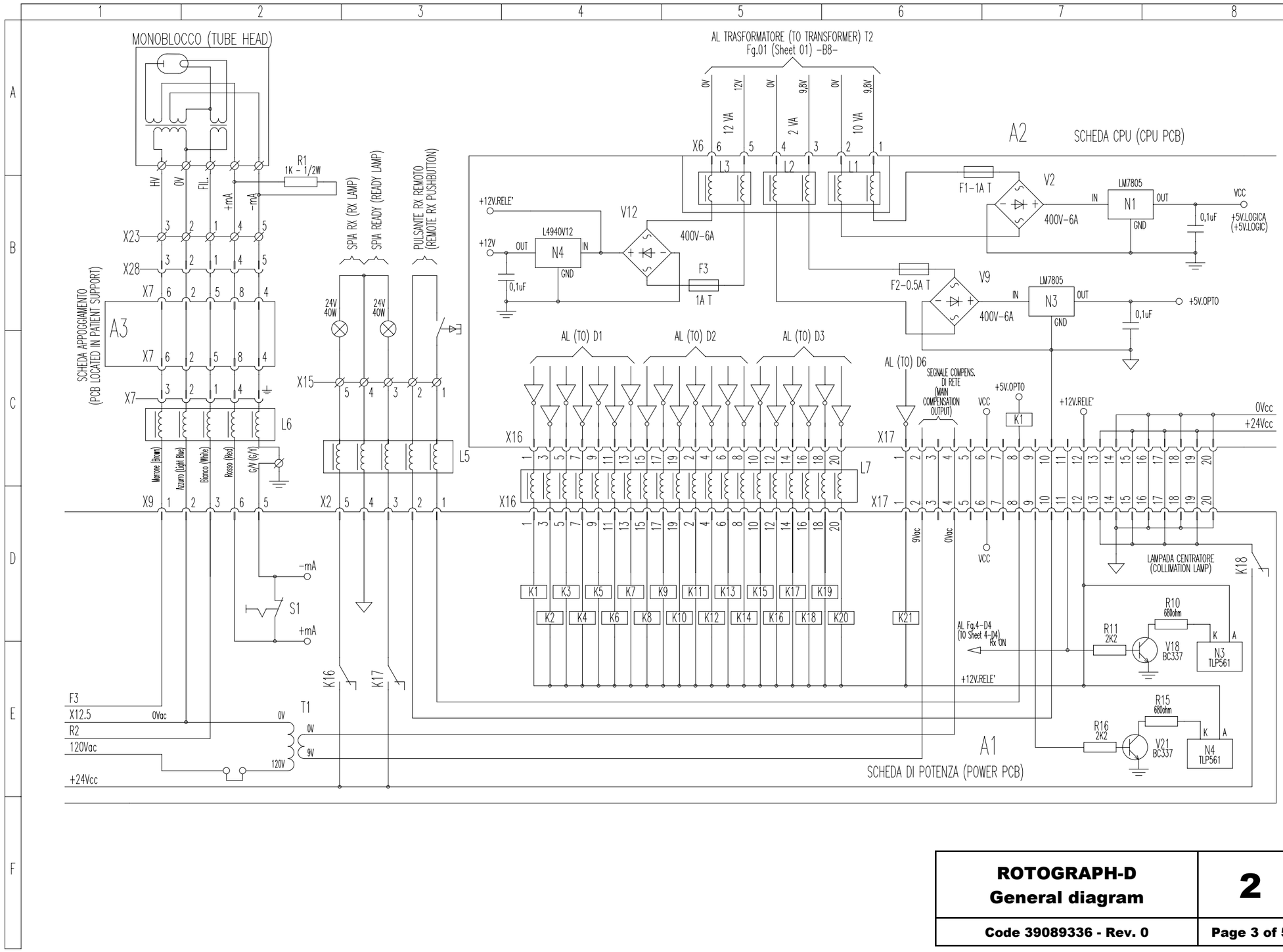
ROTOGRAPH-D Control Box layout	1
Code 72087626 - Rev. 0	Page 1 of 1



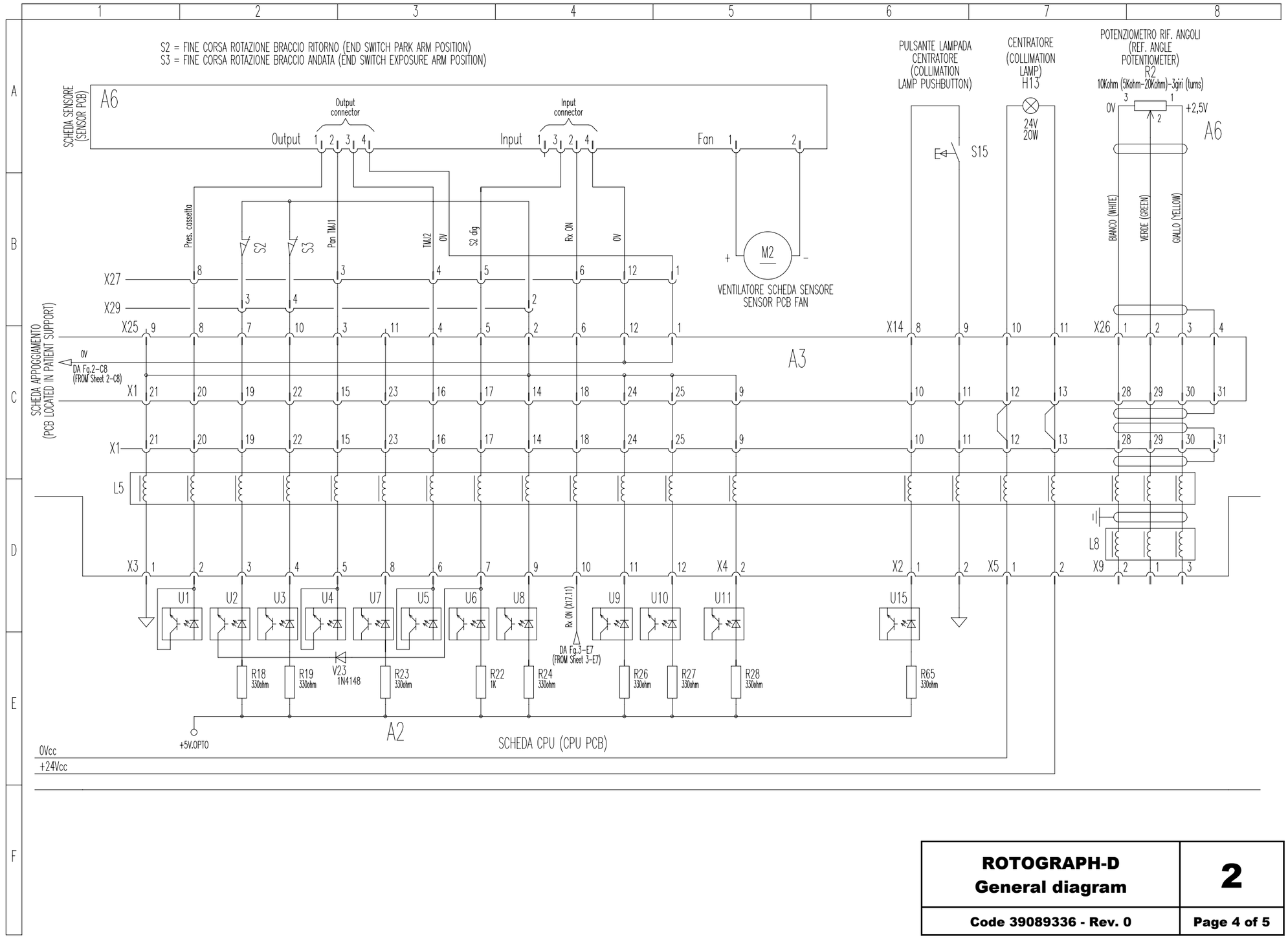
ROTOGRAPH-D General diagram	2
Code 39089336 - Rev. 0	Page 1 of 5



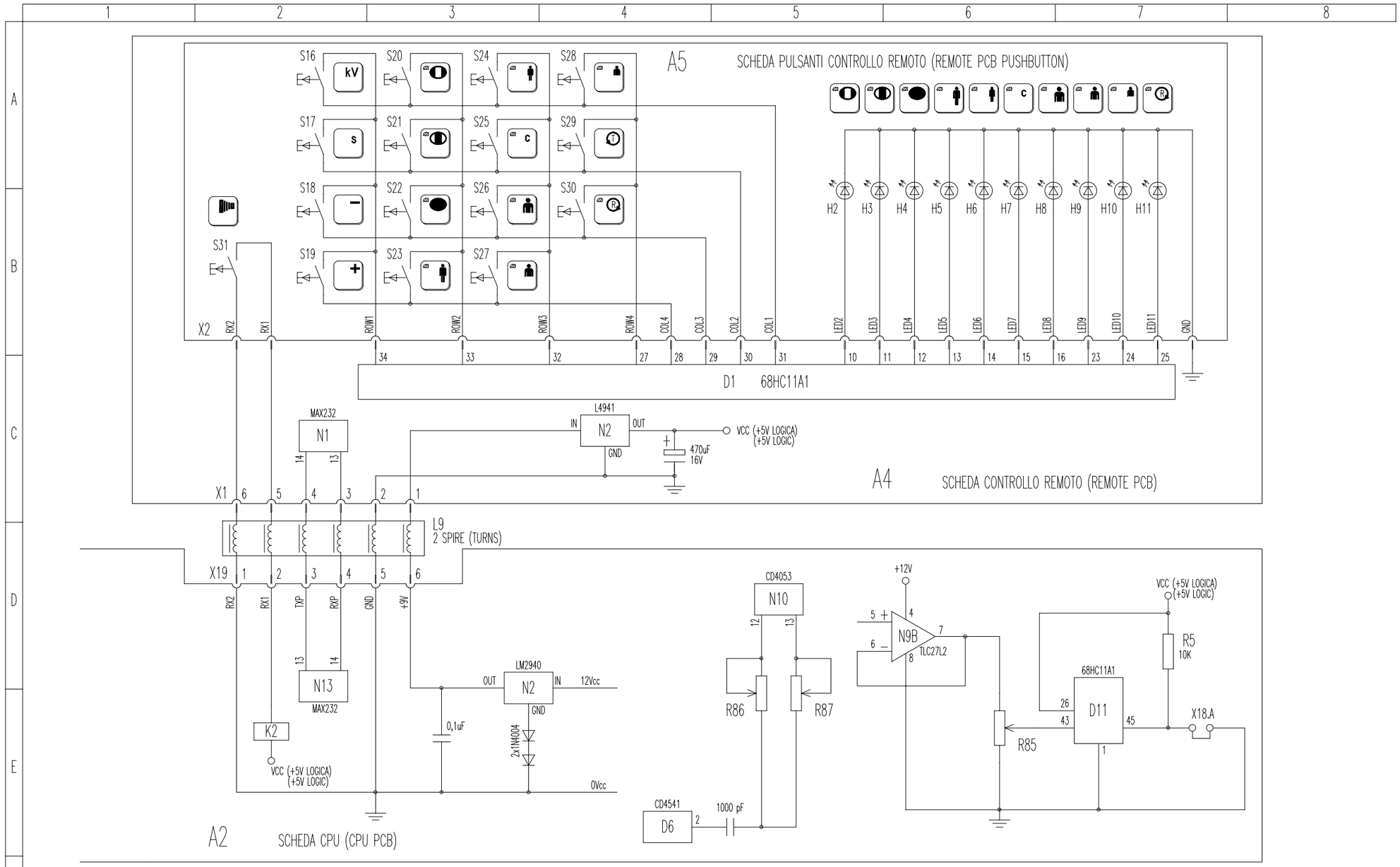
ROTOGRAPH-D General diagram	2
Code 39089336 - Rev. 0	Page 2 of 5



ROTOGRAPH-D **General diagram**	**2**
Code 39089336 - Rev. 0	**Page 3 of 5**

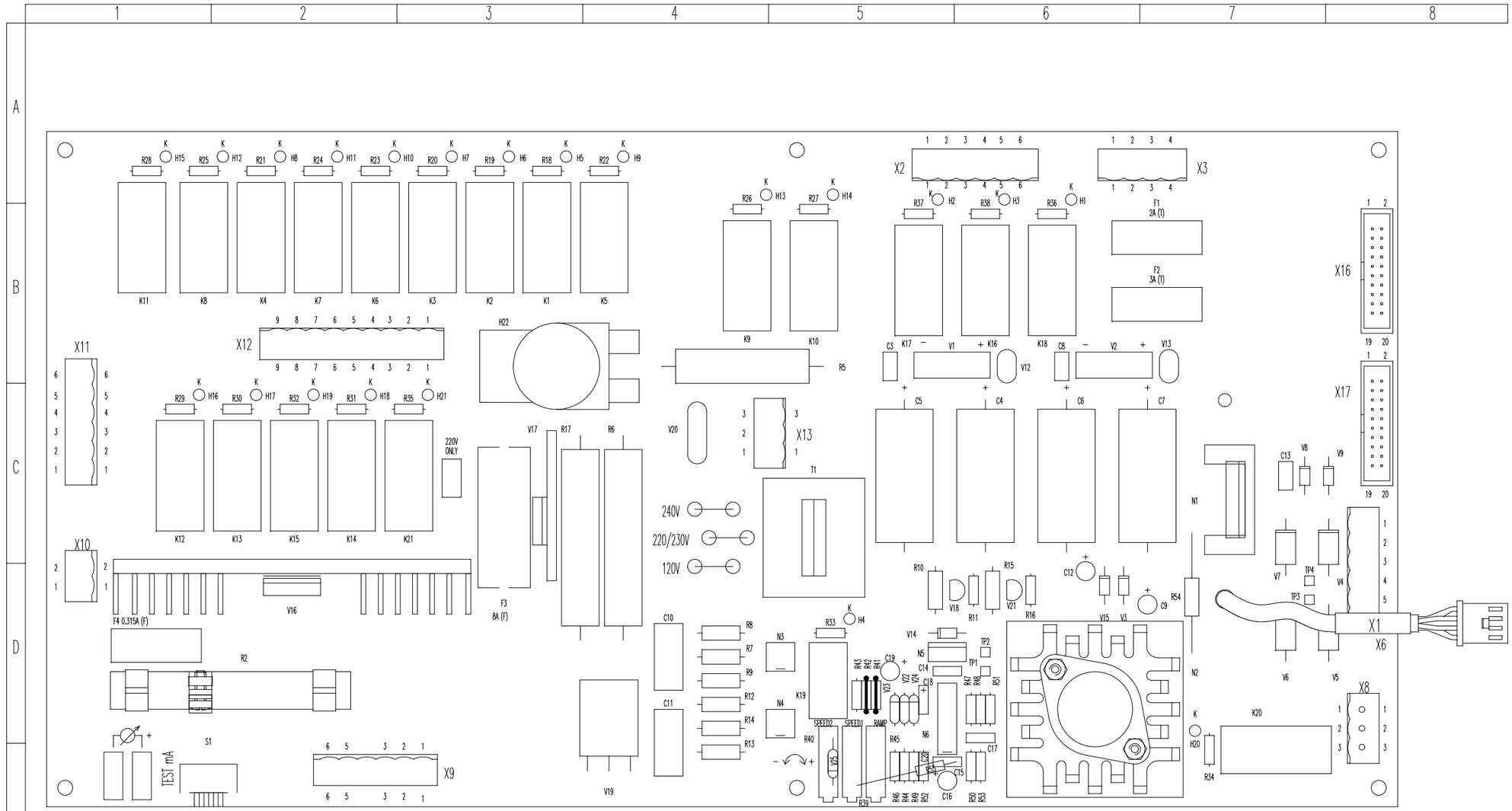


ROTOGRAPH-D General diagram	2
Code 39089336 - Rev. 0	Page 4 of 5

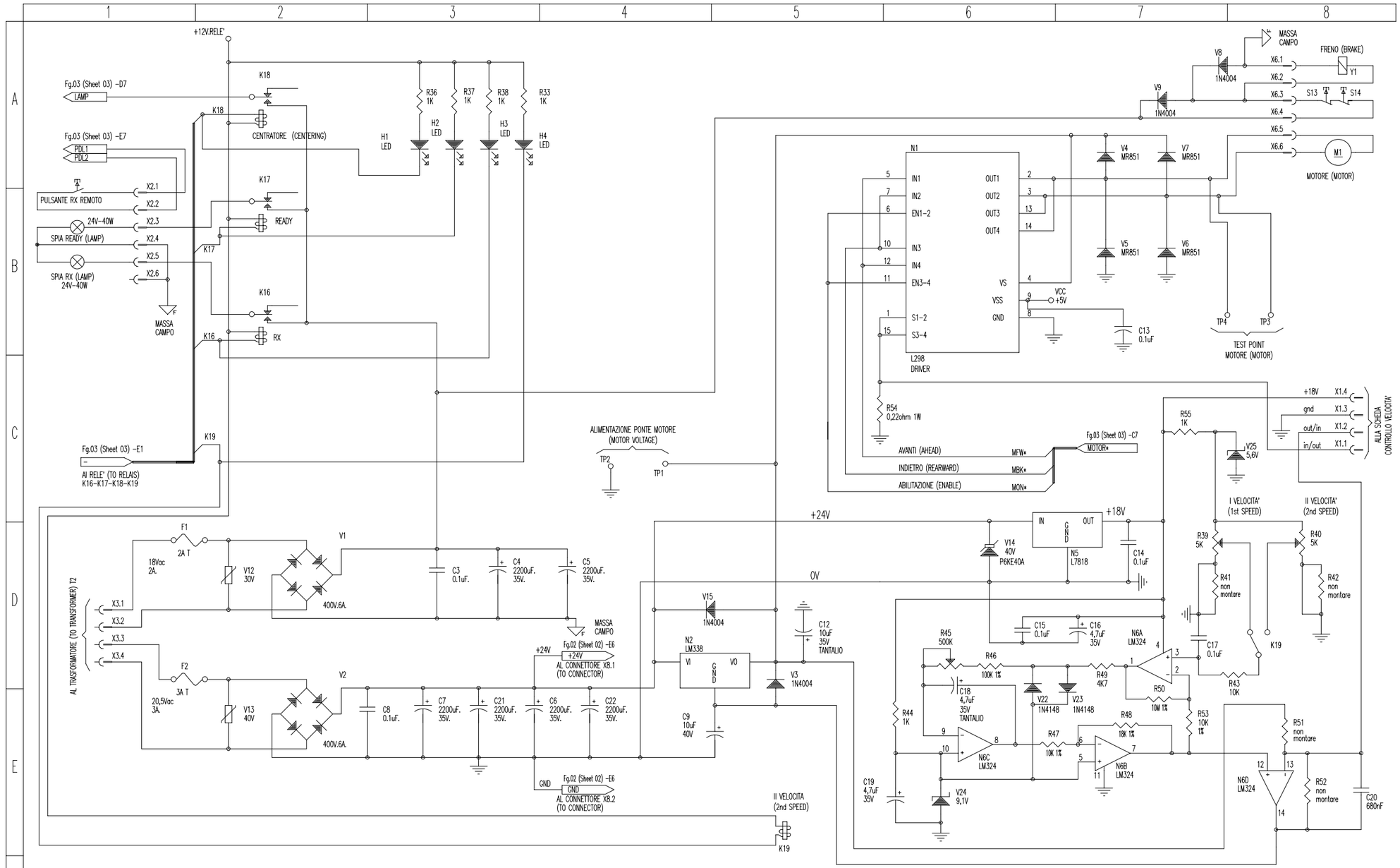


R85 = TRIMMER TARATURA TENSIONE DI RETE (TRIMMER ADJUSTMENT INPUT MAIN)
R86 = TRIMMER REGOLAZIONE TEMPO TMJ-CEPH ARRESTO RX IN SICUREZZA
(TRIMMER ADJUSTMENT DELAY STOP XRAY IN SAFETY TMJ-CEPH)
R87 = TRIMMER REGOLAZIONE TEMPO PAN. ARRESTO RX IN SICUREZZA
(TRIMMER ADJUSTMENT DELAY STOP XRAY IN SAFETY PAN.)

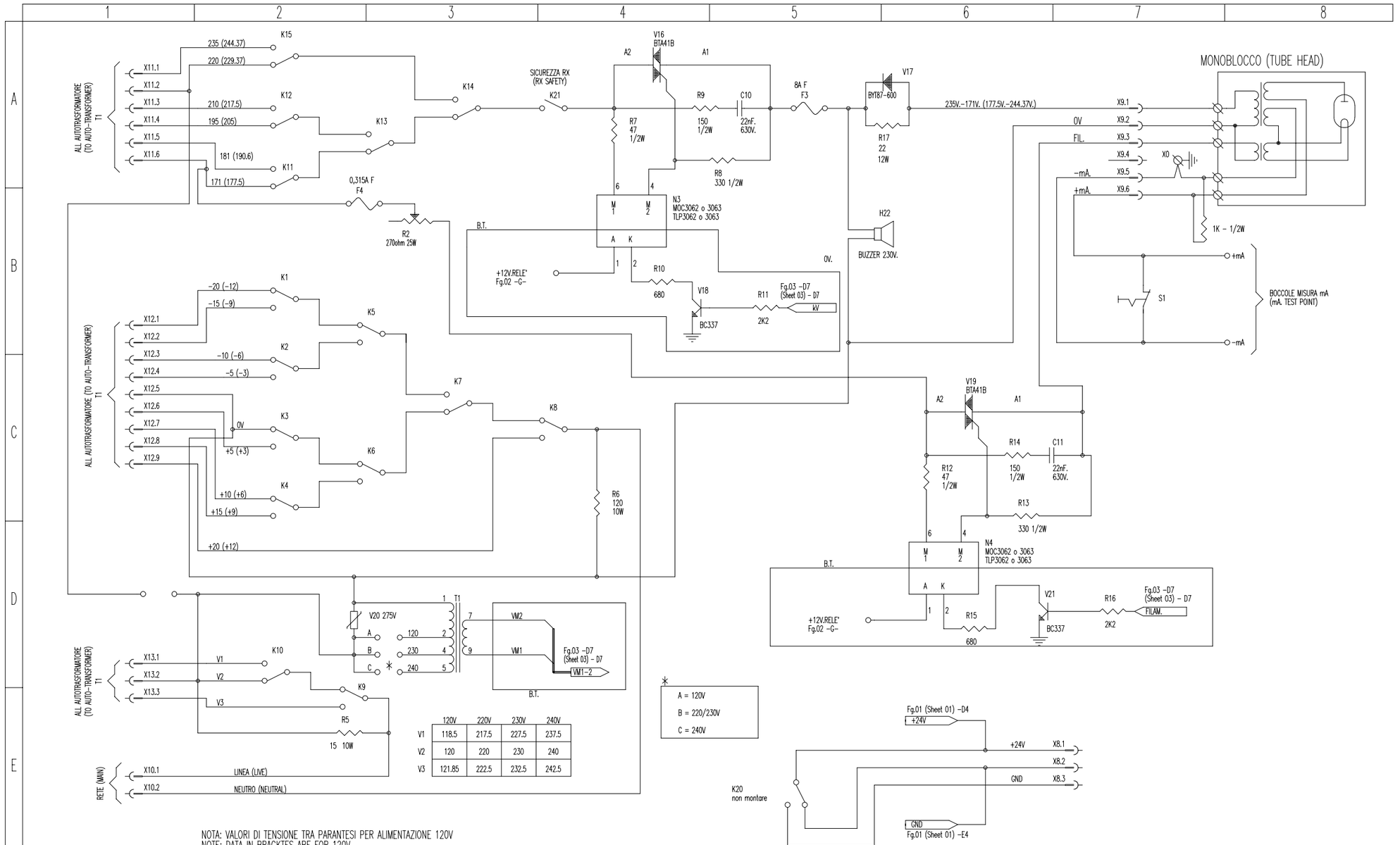
ROTOGRAPH-D **General diagram**	**2**
Code 39089336 - Rev. 0	**Page 5 of 5**



ROTOGRAPH-D **Layout Power Supply** **PCB A1**	**3**
Code 58087567 - Rev. 2	**Page 1 of 1**



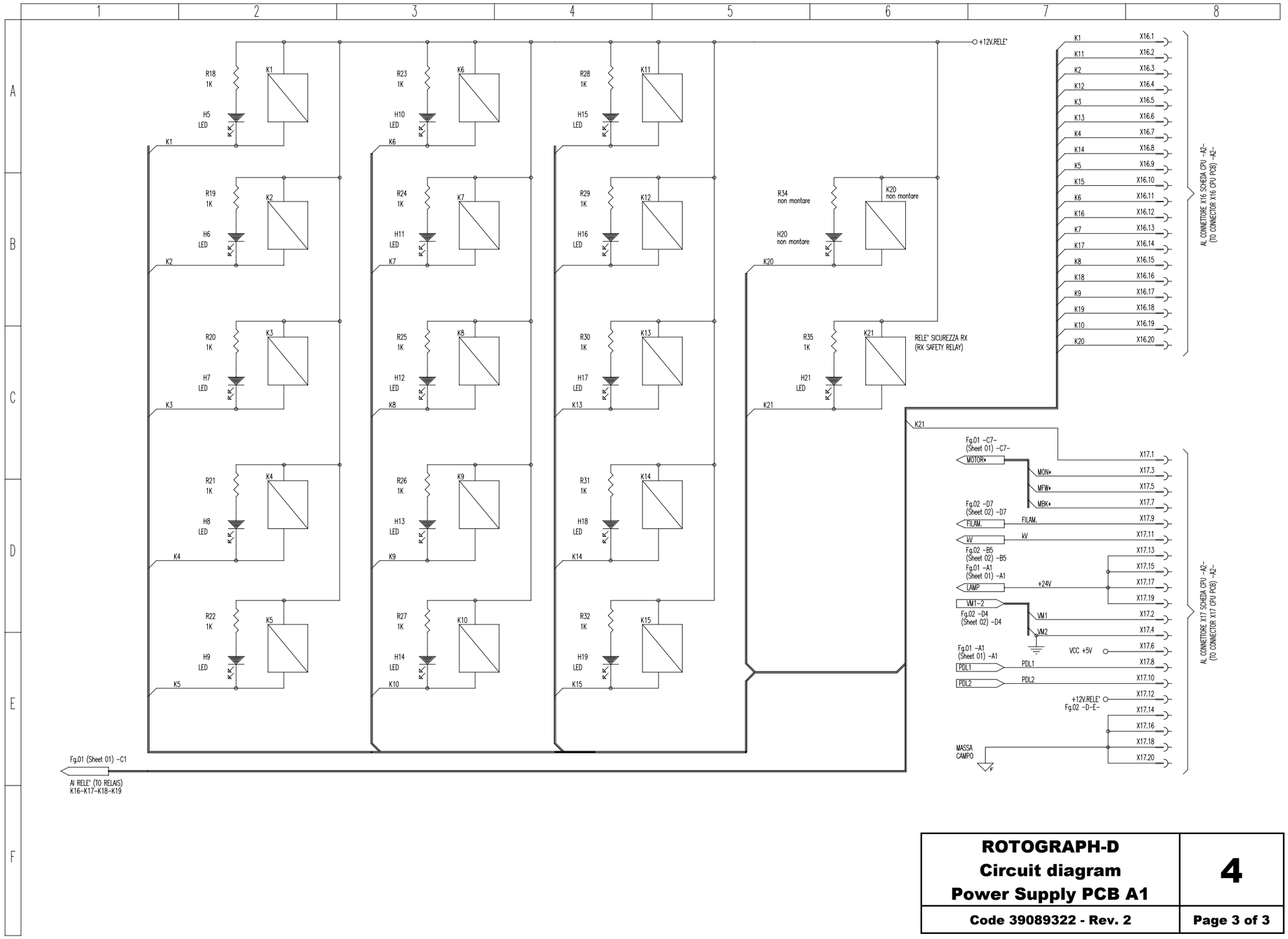
ROTOGRAPH-D **Circuit diagram** **Power Supply PCB A1**	**4**
Code 39089322 - Rev. 2	**Page 1 of 3**



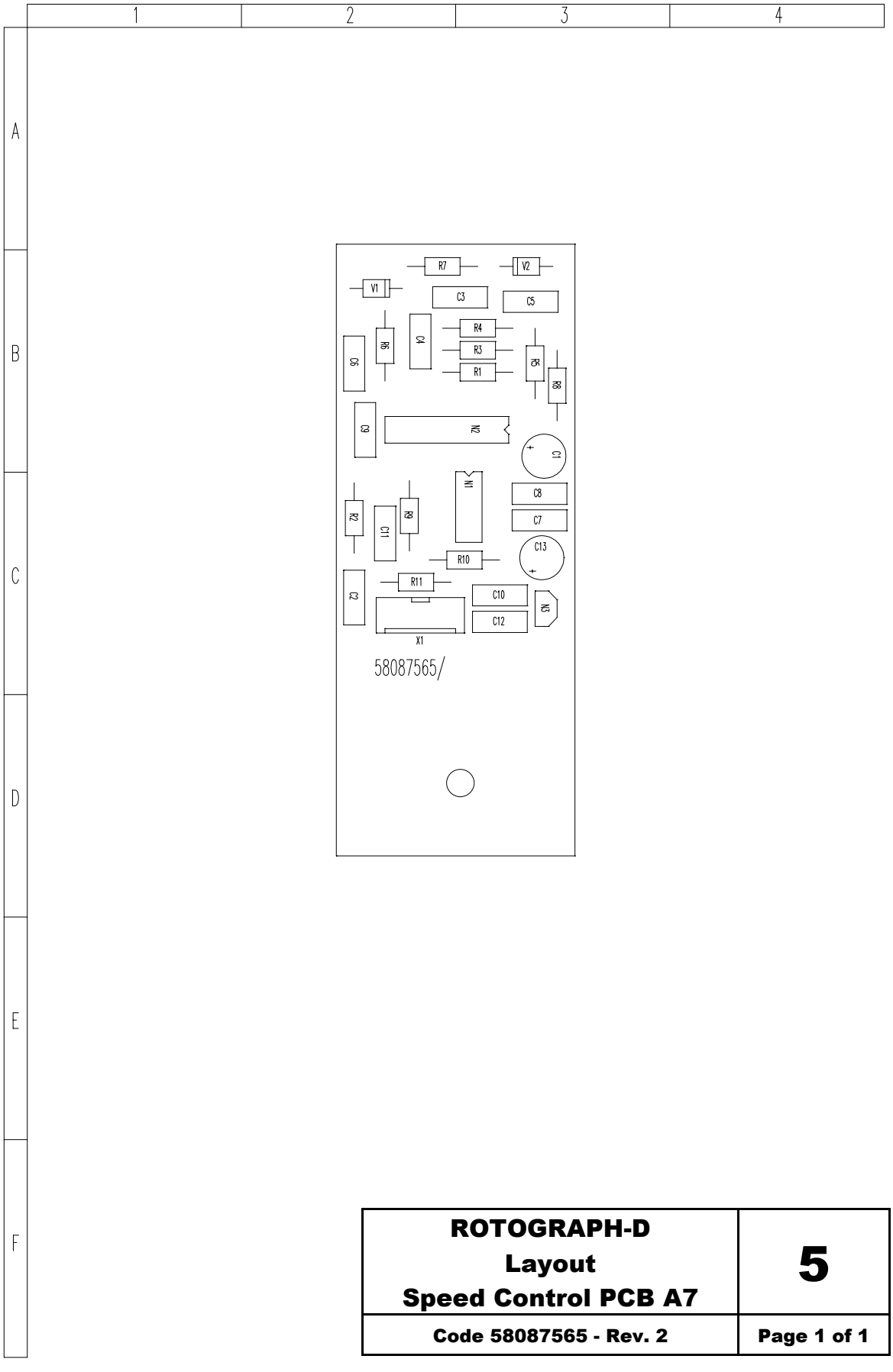
	120V	220V	230V	240V
V1	118.5	217.5	227.5	237.5
V2	120	220	230	240
V3	121.85	222.5	232.5	242.5

NOTA: VALORI DI TENSIONE TRA PARANTESI PER ALIMENTAZIONE 120V
NOTE: DATA IN BRACKTES ARE FOR 120V

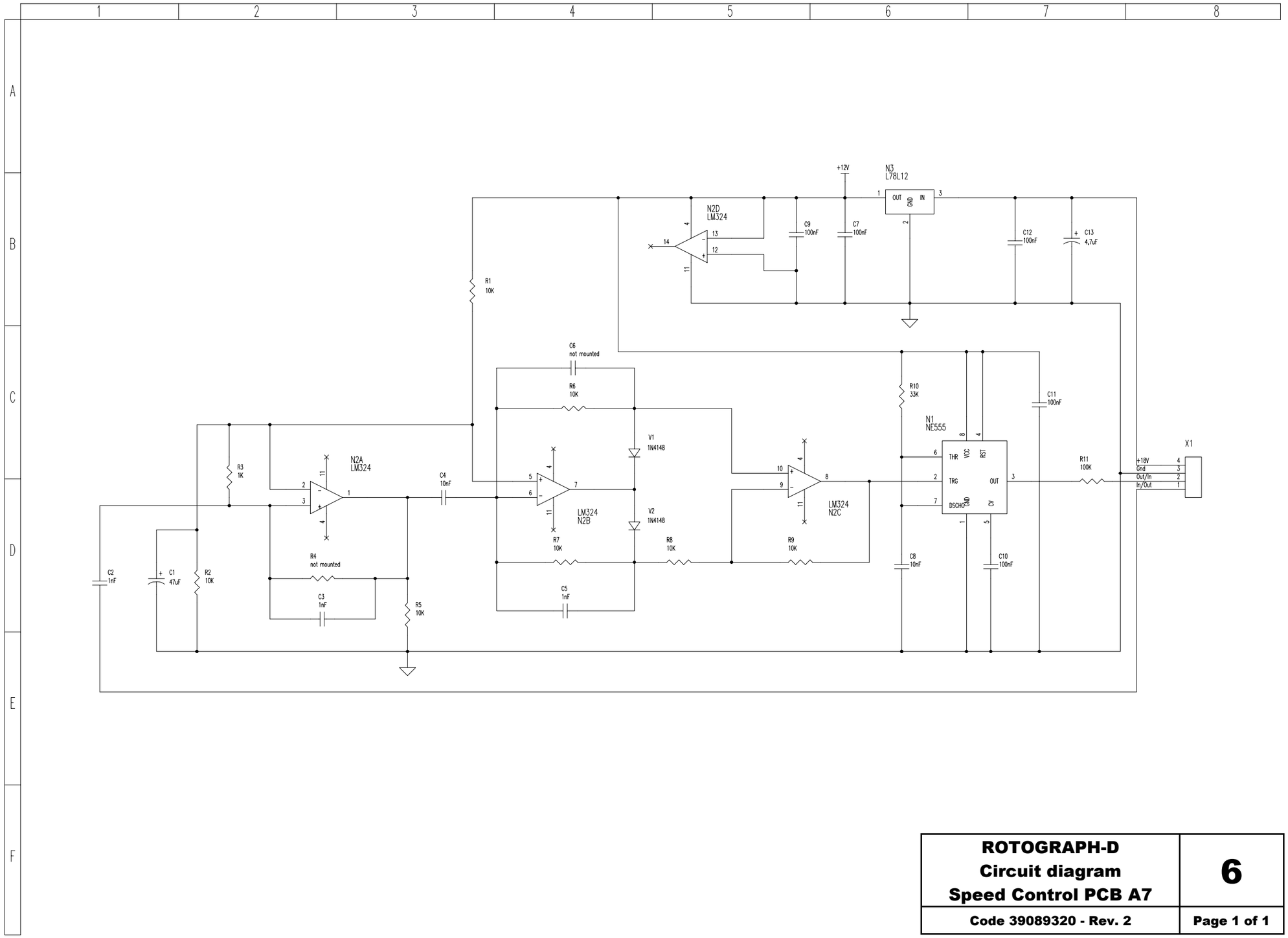
ROTOGRAPH-D **Circuit diagram** **Power Supply PCB A1**	**4**
Code 39089322 - Rev. 2	**Page 2 of 3**



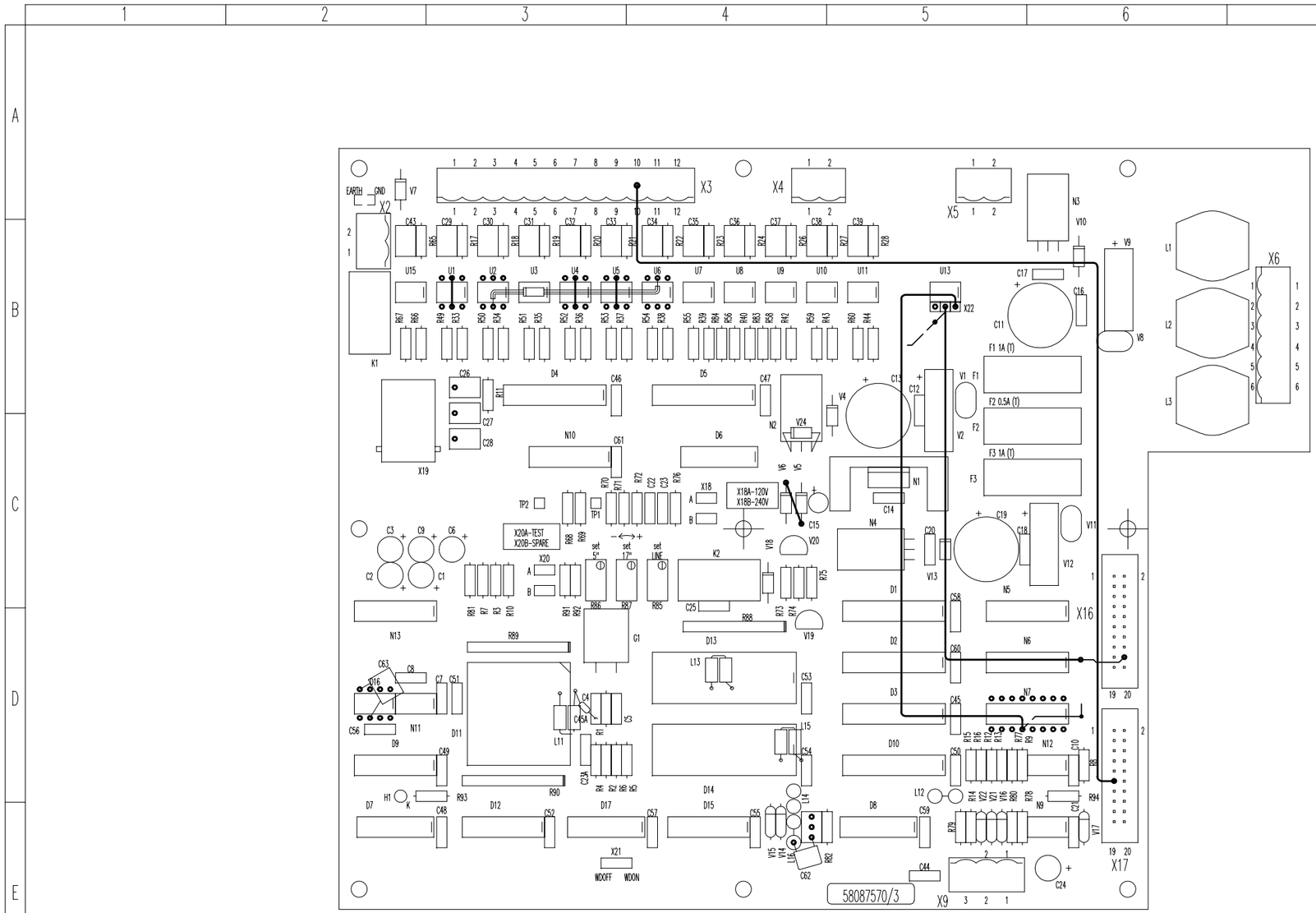
ROTOGRAPH-D **Circuit diagram** **Power Supply PCB A1**	**4**
Code 39089322 - Rev. 2	**Page 3 of 3**



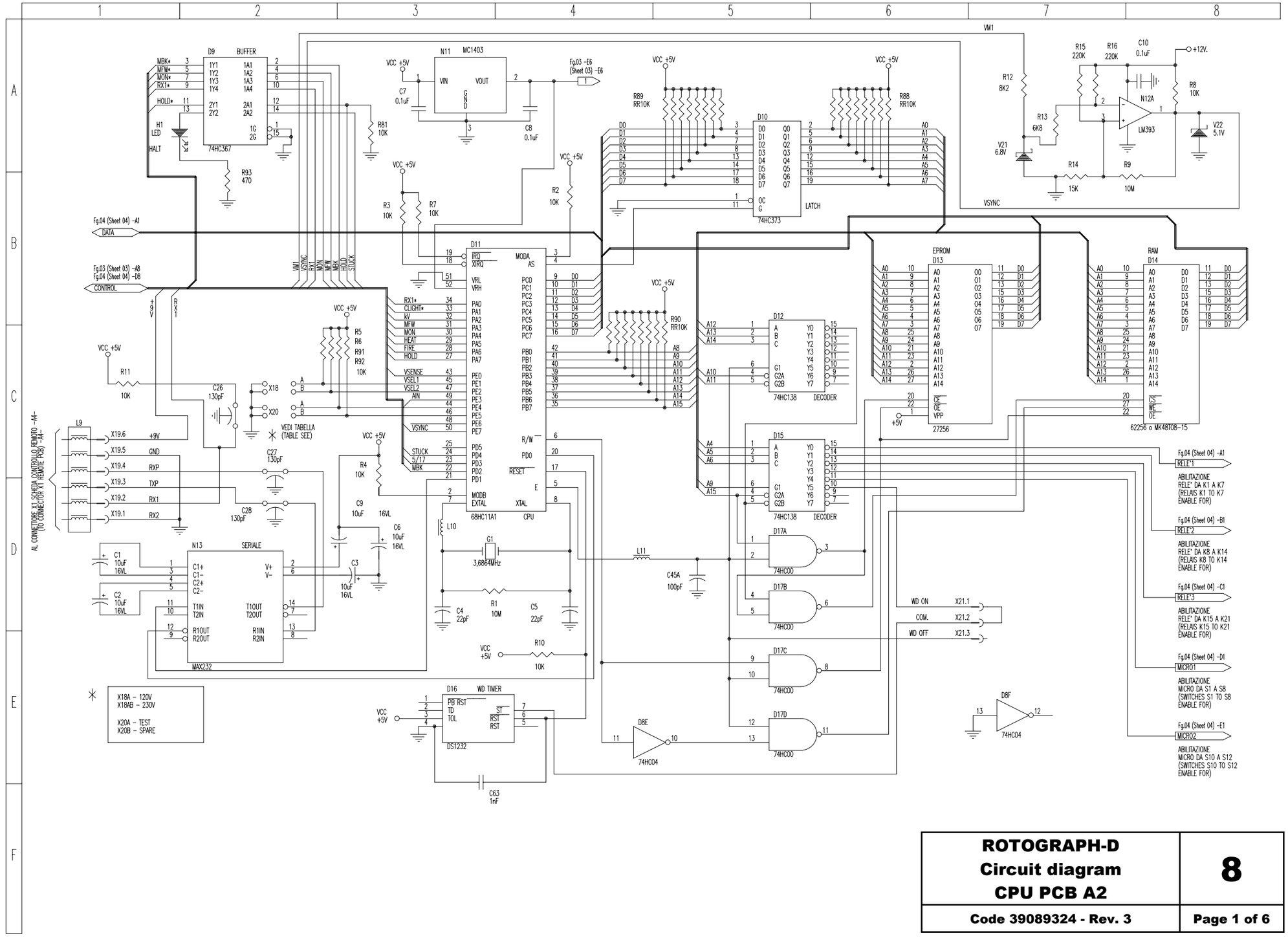
ROTOGRAPH-D Layout Speed Control PCB A7	5
Code 58087565 - Rev. 2	Page 1 of 1



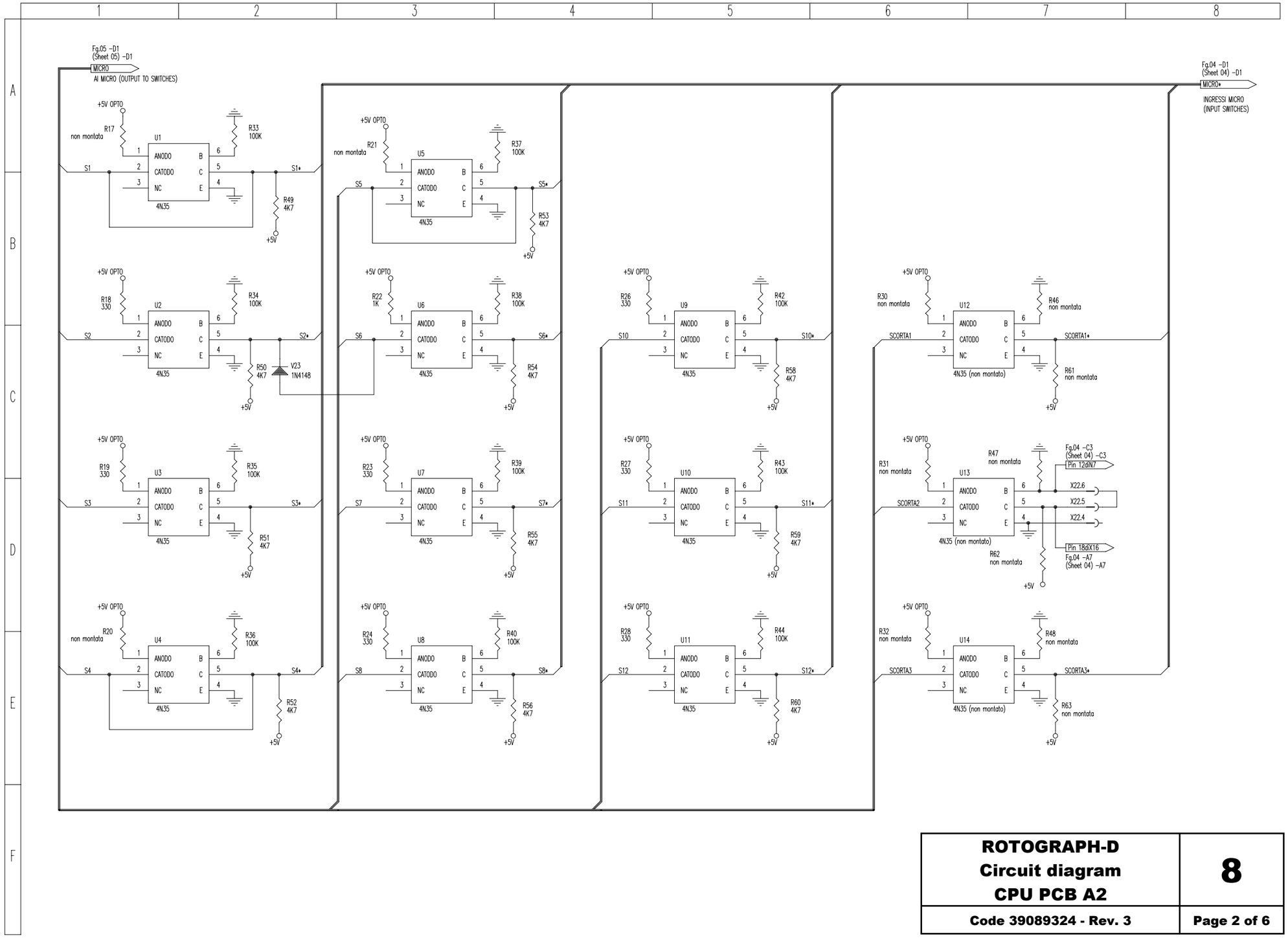
ROTOGRAPH-D **Circuit diagram** **Speed Control PCB A7**	**6**
Code 39089320 - Rev. 2	**Page 1 of 1**



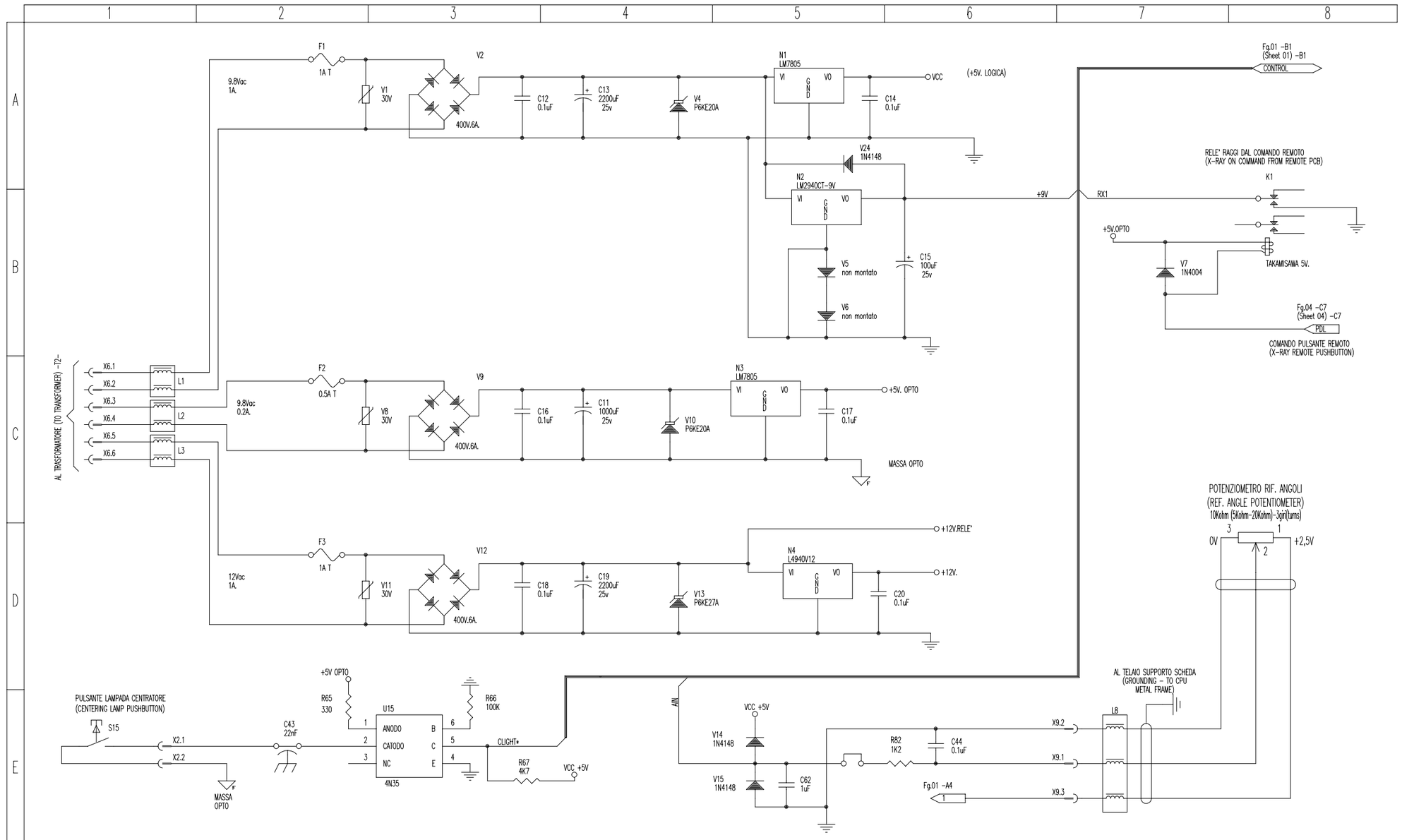
ROTOGRAPH-D Layout CPU PCB A2	7
Code 58087570 - Rev. 3	Page 1 of 1



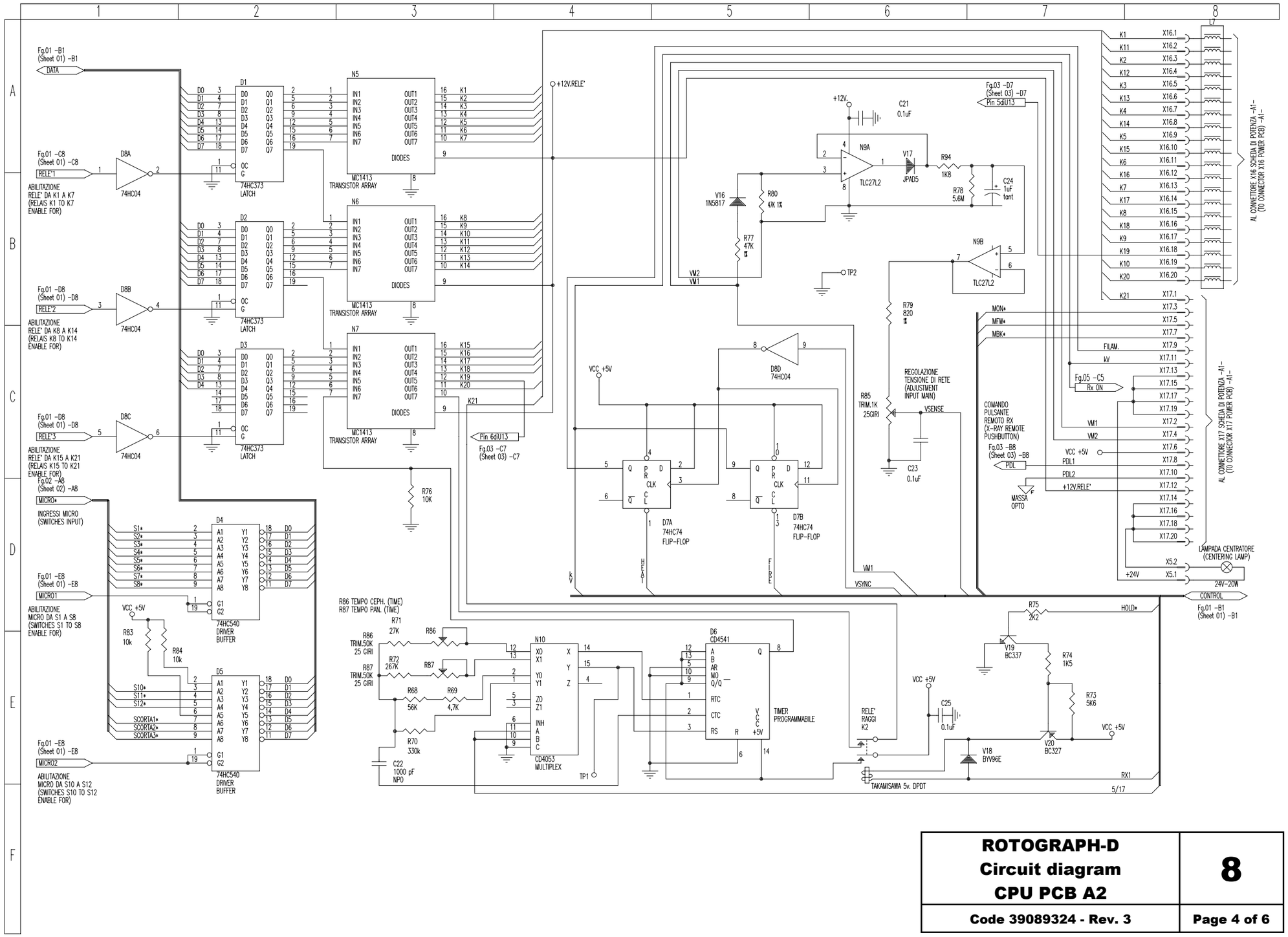
ROTOGRAPH-D **Circuit diagram** **CPU PCB A2**	**8**
Code 39089324 - Rev. 3	**Page 1 of 6**



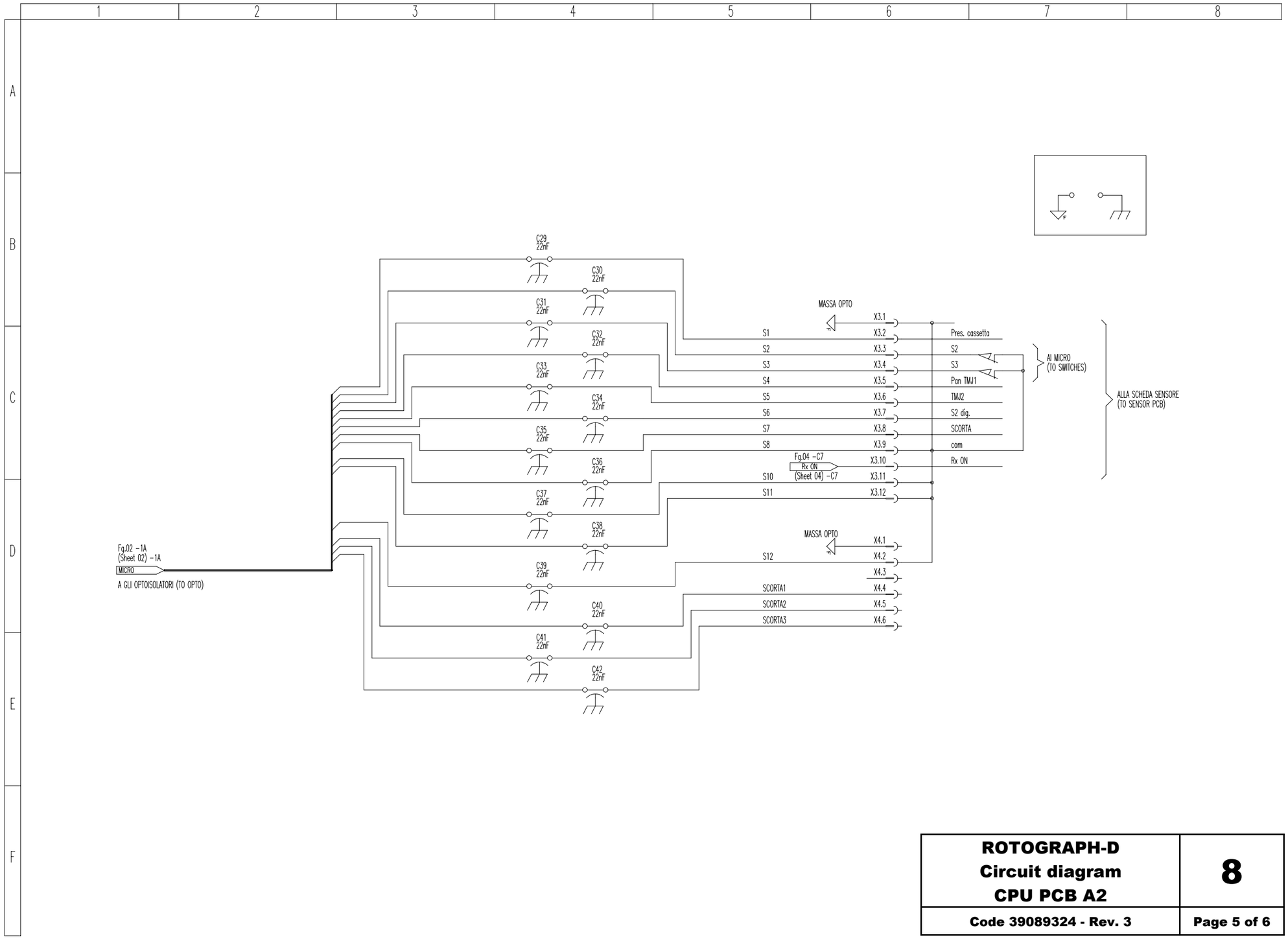
ROTOGRAPH-D Circuit diagram CPU PCB A2	8
Code 39089324 - Rev. 3	Page 2 of 6



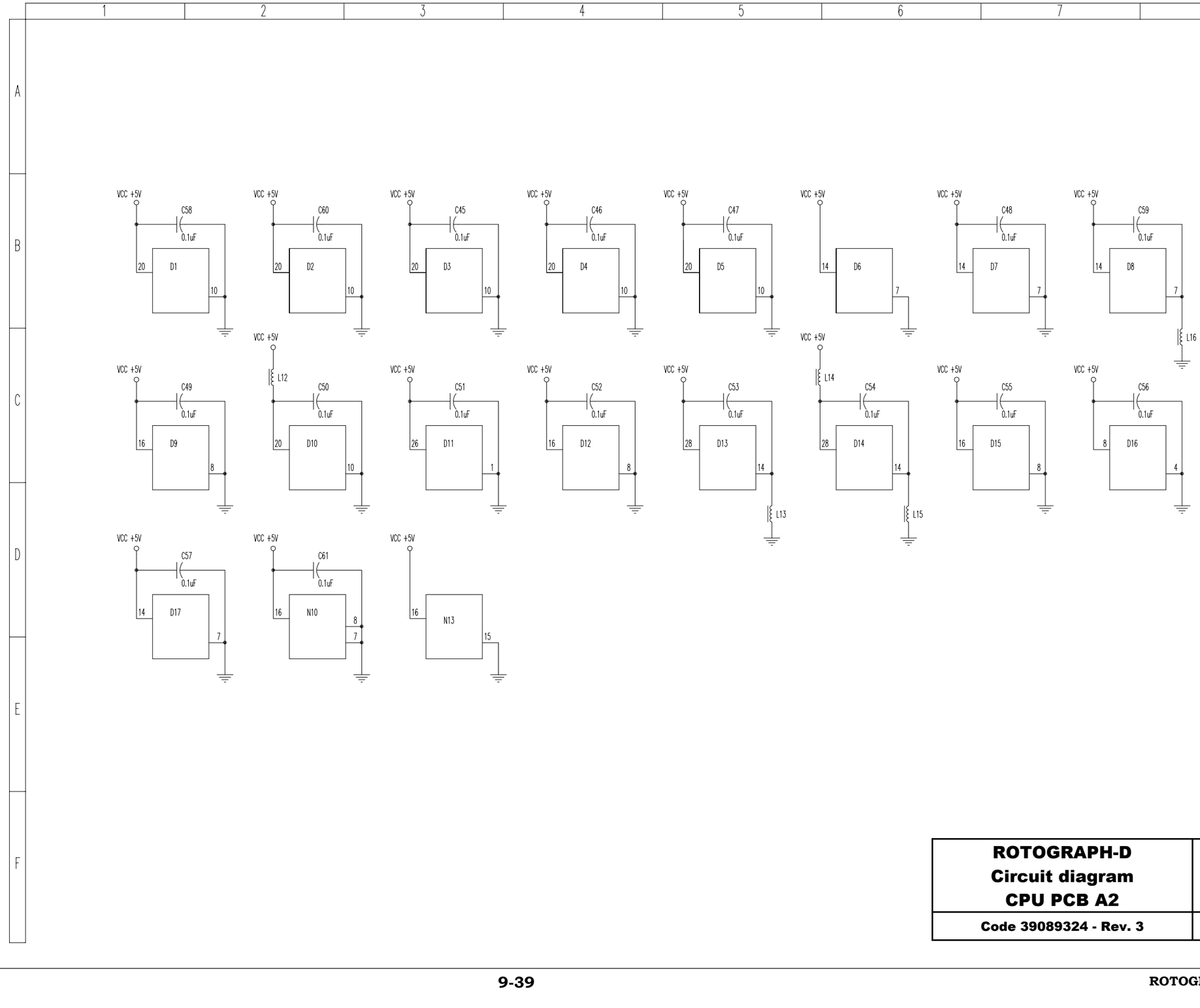
ROTOGRAPH-D **Circuit diagram** **CPU PCB A2**	**8**
Code 39089324 - Rev. 3	**Page 3 of 6**



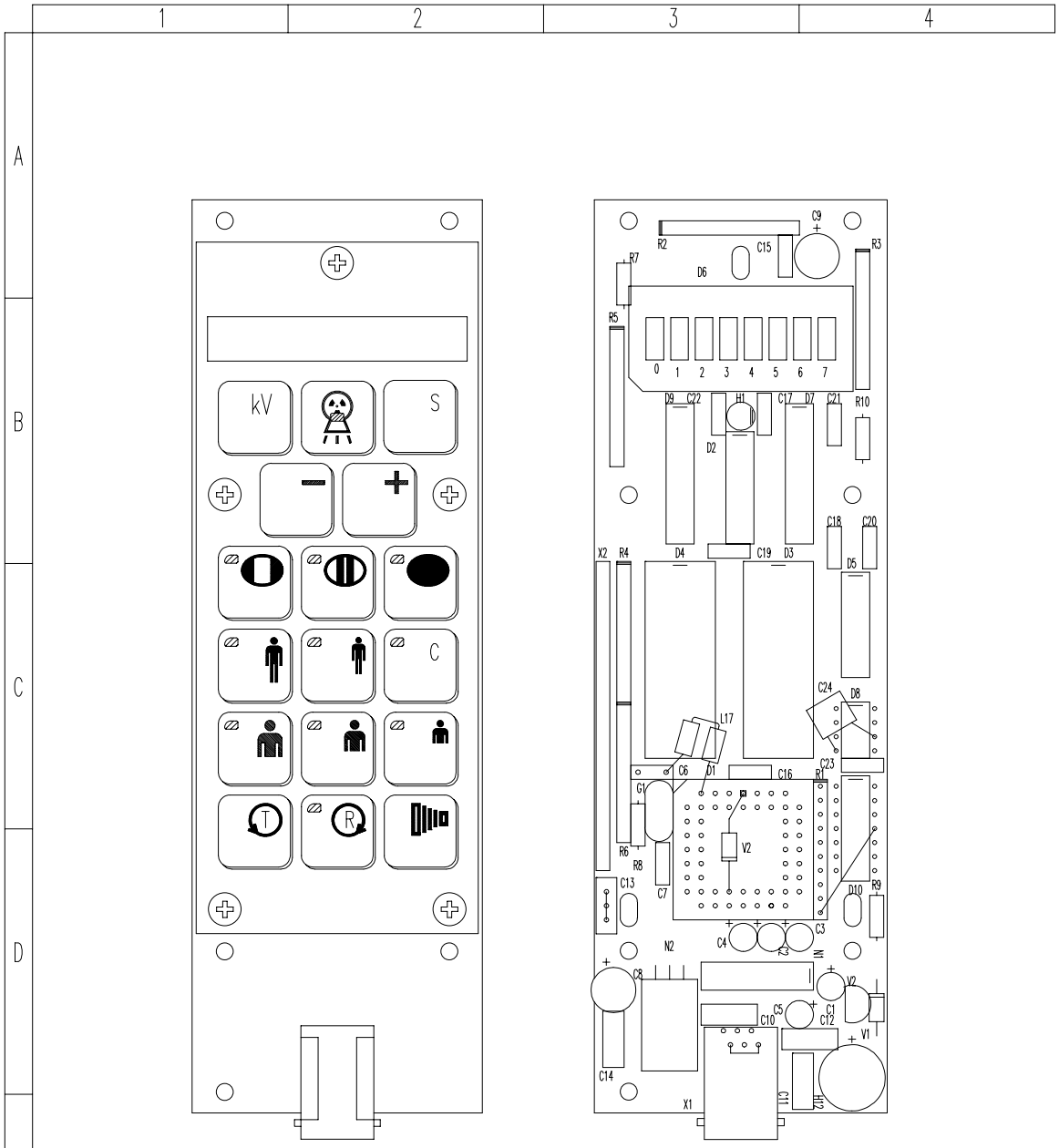
ROTOGRAPH-D **Circuit diagram** **CPU PCB A2**	**8**
Code 39089324 - Rev. 3	**Page 4 of 6**



ROTOGRAPH-D **Circuit diagram** **CPU PCB A2**	**8**
Code 39089324 - Rev. 3	**Page 5 of 6**



ROTOGRAPH-D Circuit diagram CPU PCB A2	8
Code 39089324 - Rev. 3	Page 6 of 6



ROTOGRAPH-D Layout Remote Control PCB	9
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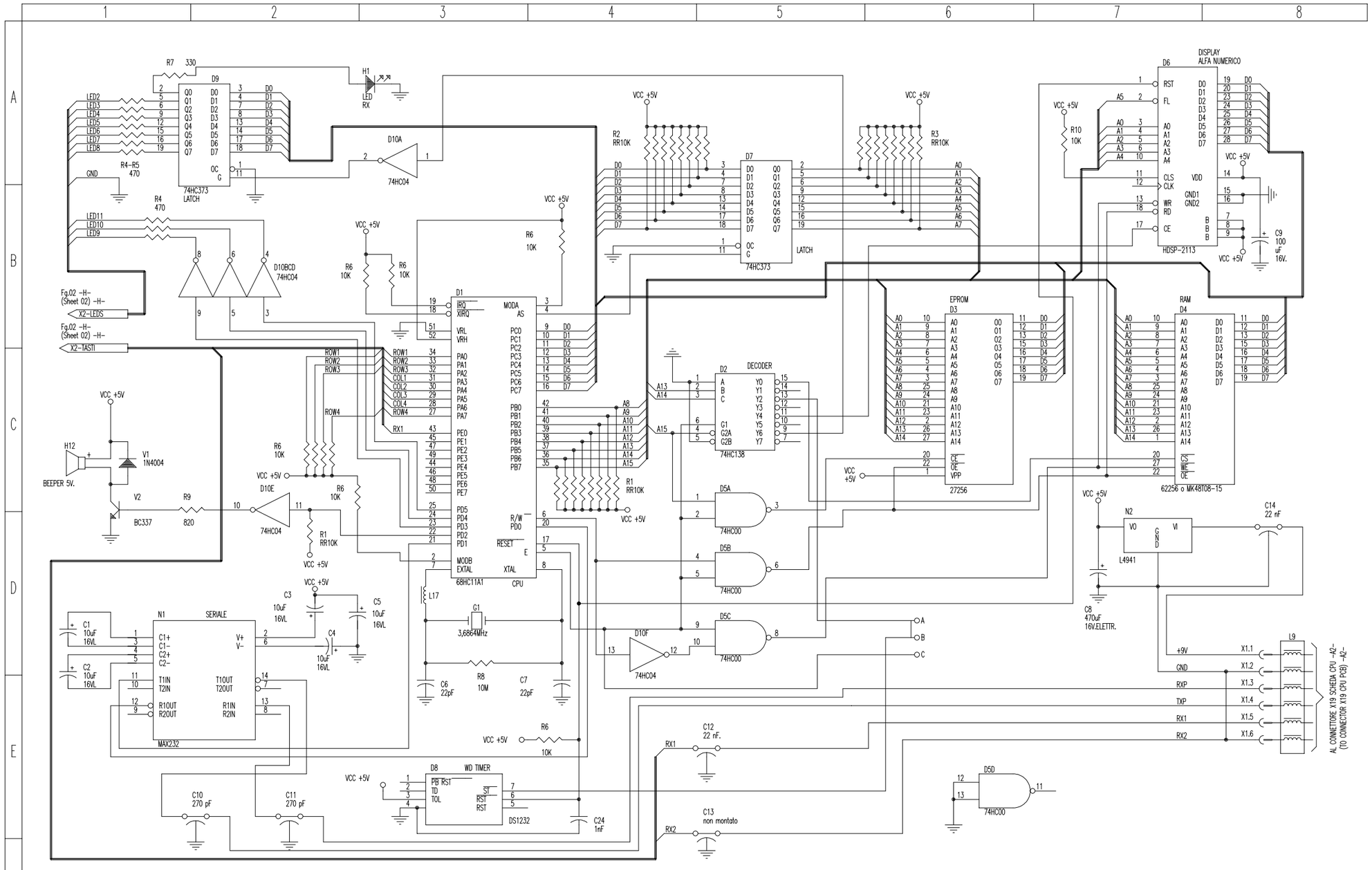
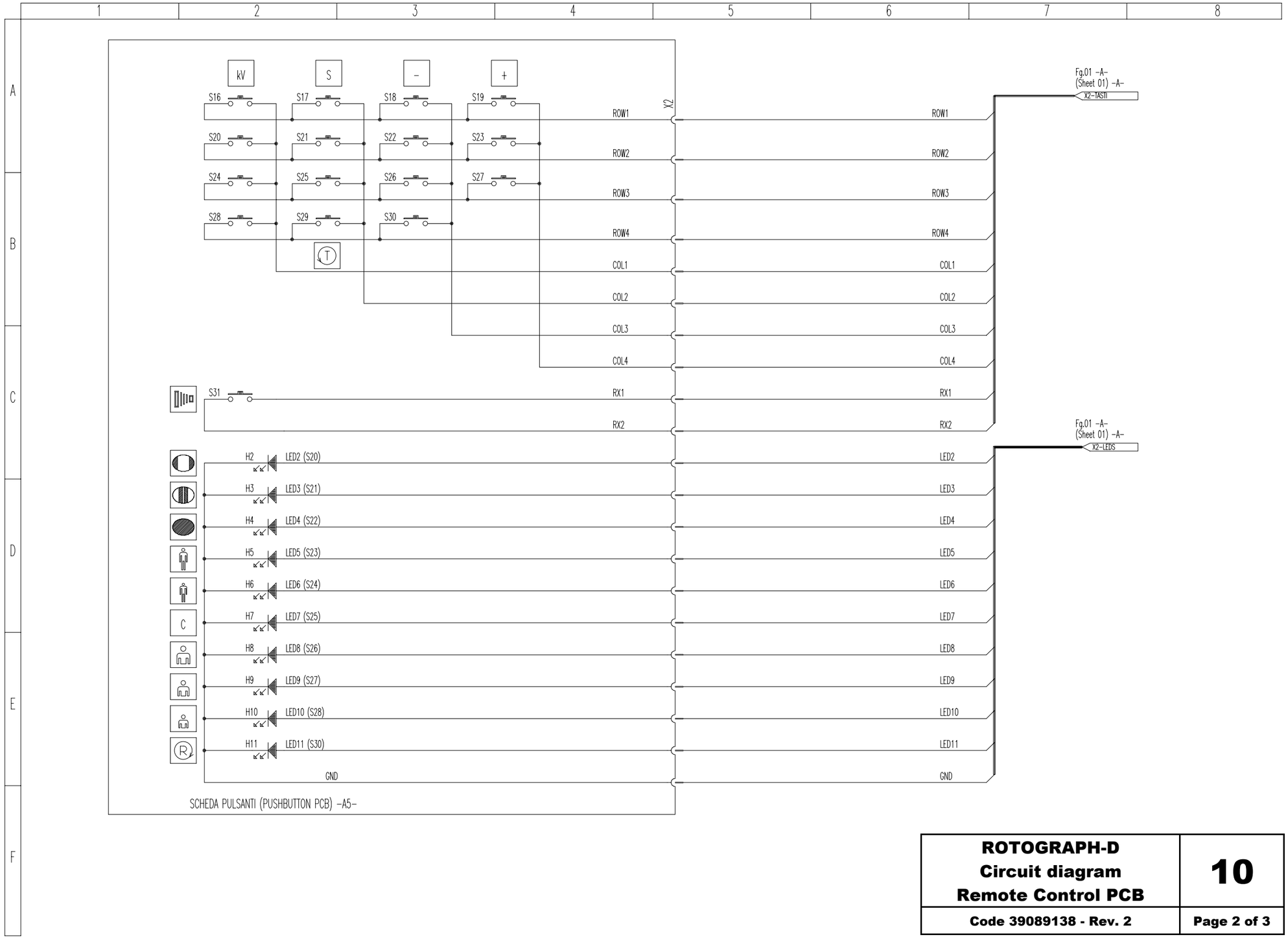
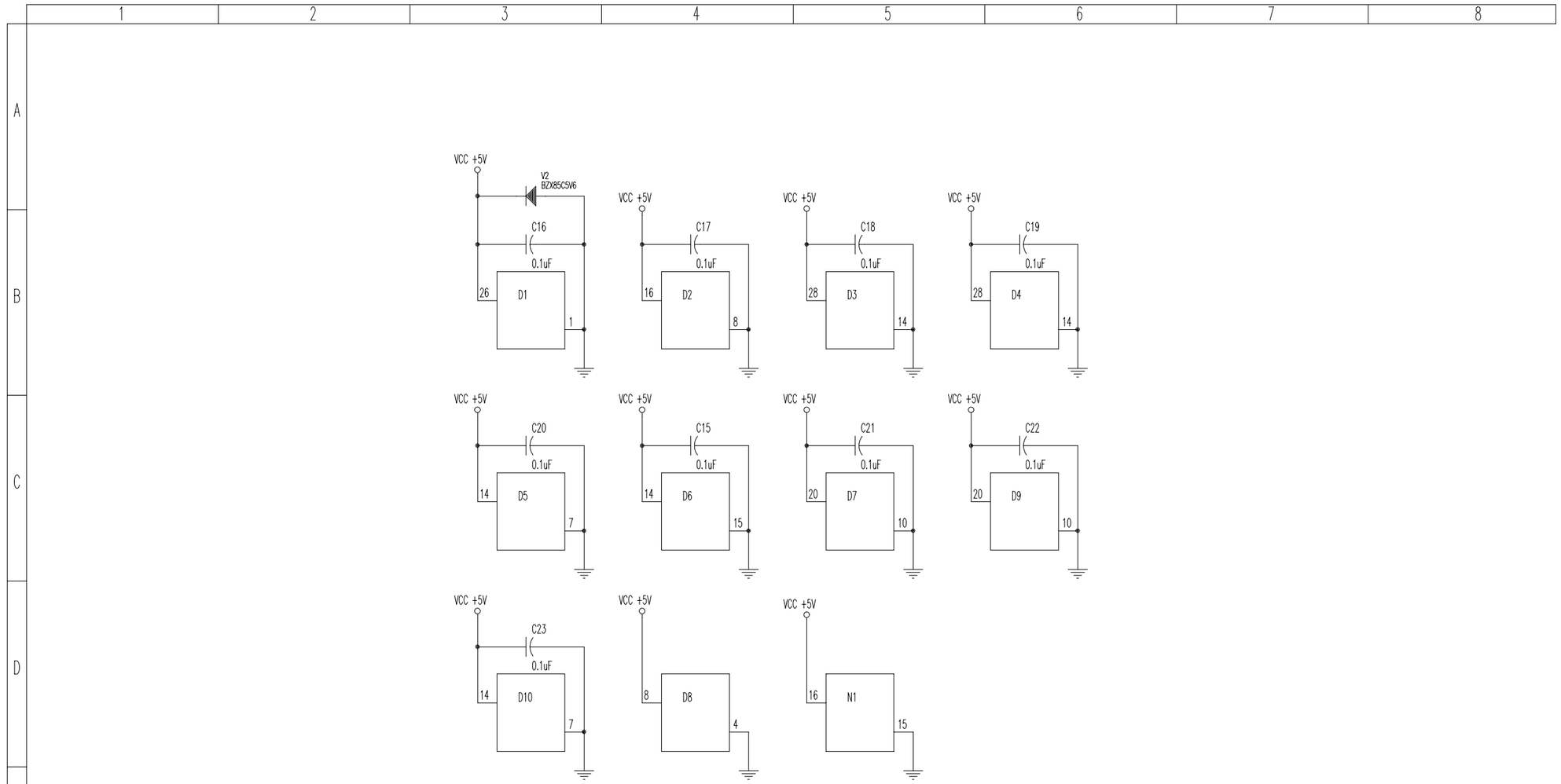


ROTOGRAPH-D **Circuit diagram** **Remote Control PCB**	**10**
Code 39089138 - Rev. 2	**Page 1 of 3**



ROTOGRAPH-D Circuit diagram Remote Control PCB	10
Code 39089138 - Rev. 2	Page 2 of 3



ROTOGRAPH-D Circuit diagram Remote Control PCB	10
Code 39089138 - Rev. 2	Page 3 of 3

10. SPARE PARTS

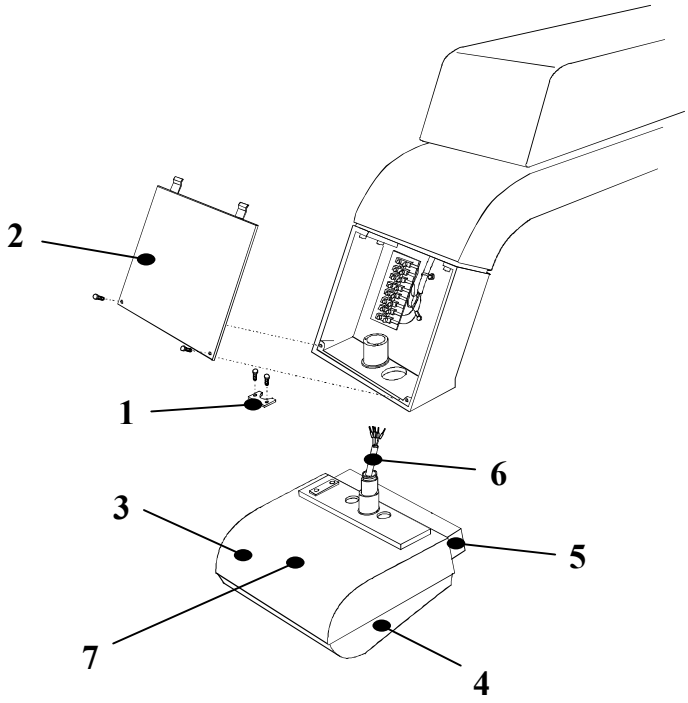
1 - STAND

2 – CONTROL BOX

3 - ACCESSORIES

1 - STAND

Ref.	Order code	Description	Note
1	5108400600	Safety plate for Tube head block	
2	5608433605	Tube head arm cover	
3	5608661005	Upper Tube head cover	
4	5608661103	Lower Tube head cover	
5	6608661203	Collimator cover	
6	6208610500	Tube head cable	
7	6608660003	Tube head Assembly	
8	6608140000	X1 + X7 with tube housing	
9	7108122005	Counterweight pulley Assembly	
10	5008120100	Counterweight rope	
11	6608106000	Counterweight chain and ropes Assy	
12	4492706700	HUB USB2	
-	5009318300	USB2 cable (L=5mt)	
-	8108126005	Wall mounting kit (without legs)	
-	8108127003	Floor mounting kit (with legs)	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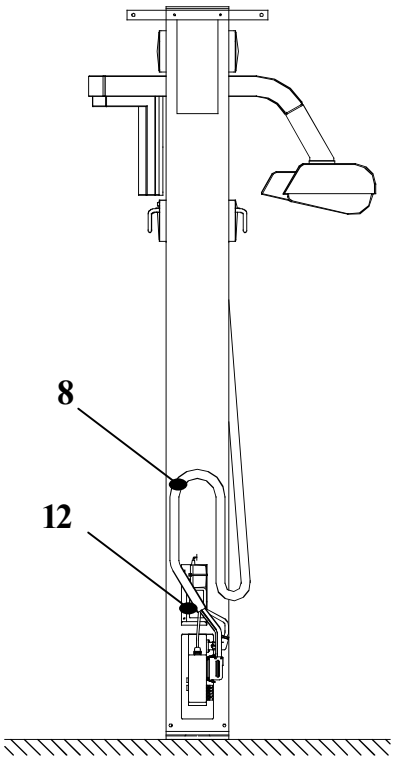
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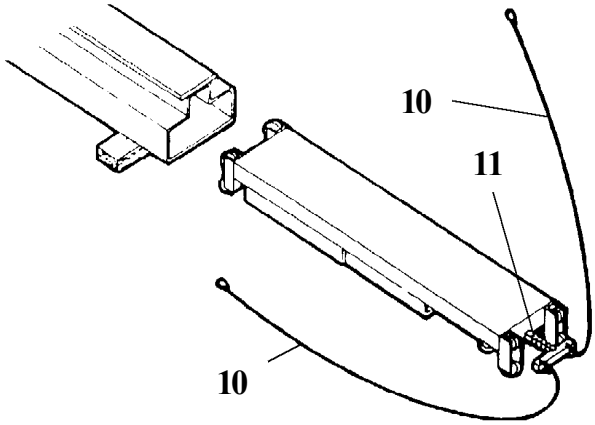
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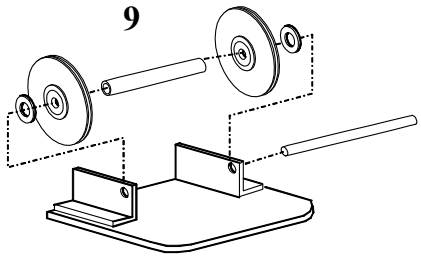
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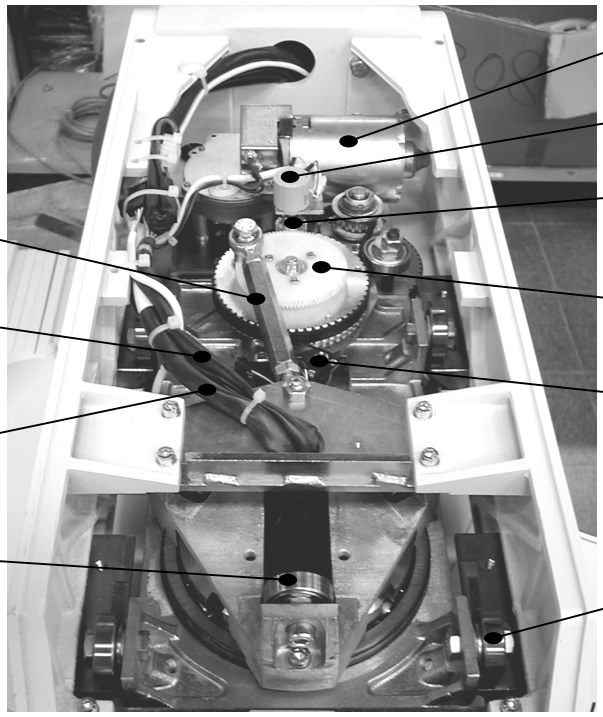
Ref.	Order code	Description	Note
1	6108317000	Connecting rod Assembly	
2	6608318900	Motor with gear box Assembly	
3	4192004000	Potentiometer for angular check	
4	5971313900	Small gear for potentiometer	
5	5908323100	Big gear for potentiometer	
6	6608317700	Eccentric Ball bearing Assembly	
7	6608310600	Central ball bearing Assembly	
8	6208324900	Stop-Starter microswitch	
9	6208532000	Signal cable N°2	
10	6208526700	Tube head internal cable	
11	4908315900	Toothed belt	
12	6608317600	Chain Assembly	
13	6108312700	Tightener Assembly	
14	6608314900	Eccentric Ball bearing Assembly	
15	5608433405	Lower rotating arm cover	
16	7108520003	Temples clamp	
17	5708801600	Temples clamp friction spring	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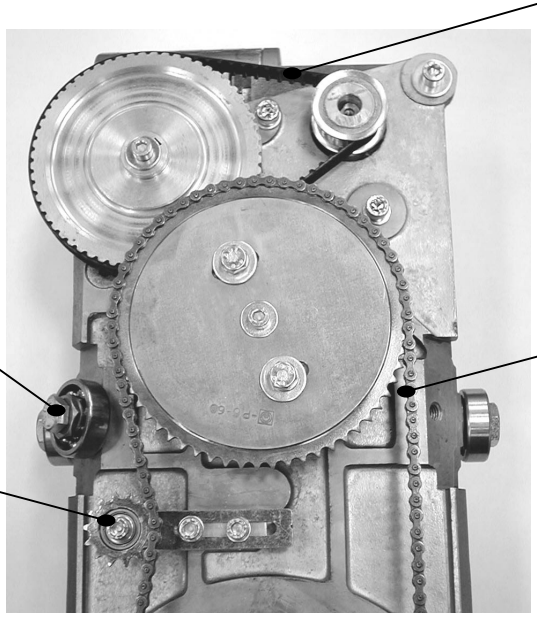
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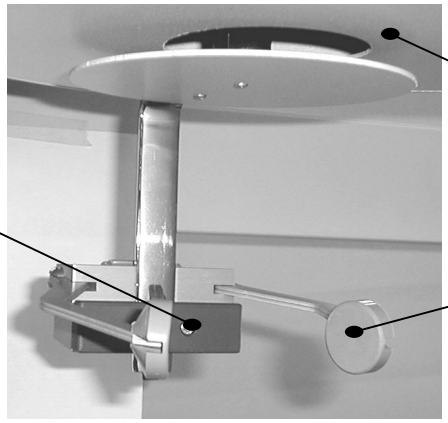
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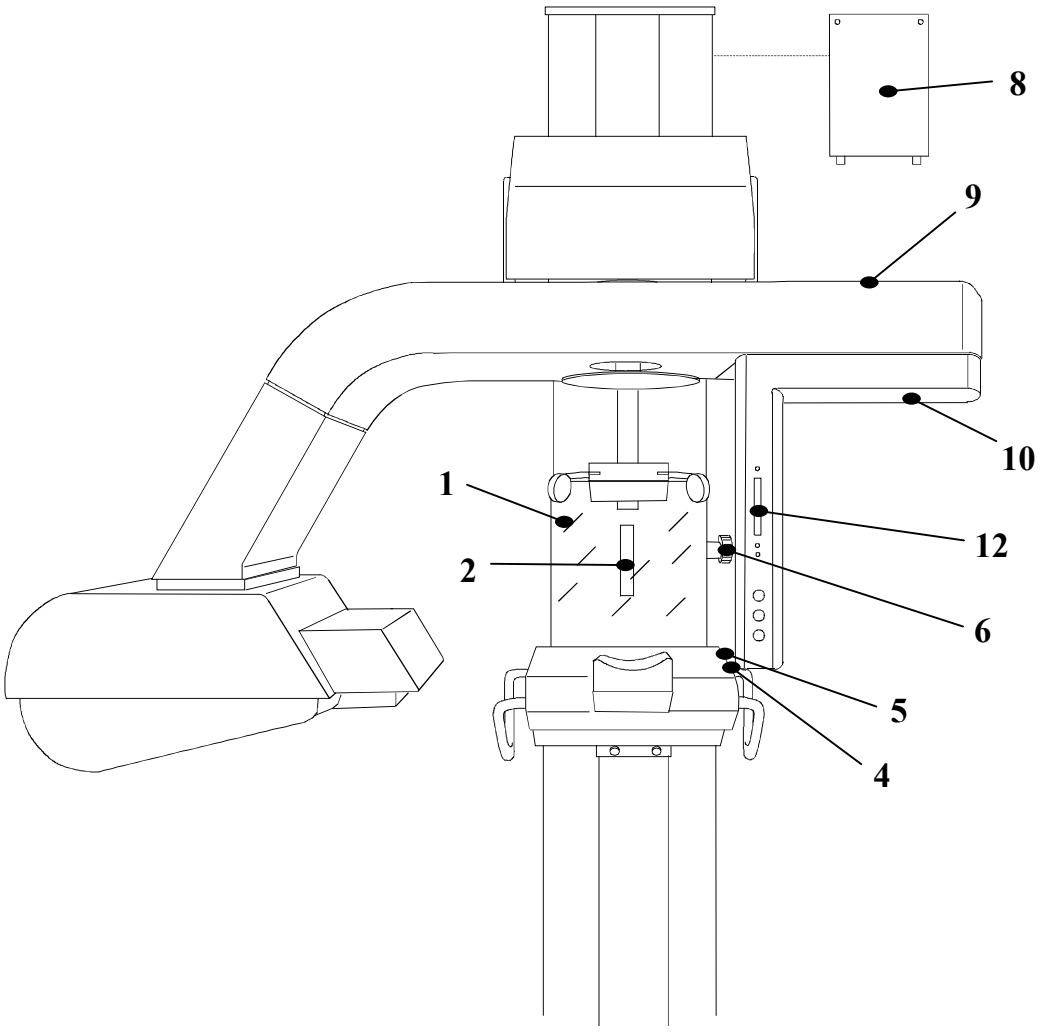
Ref.	Order code	Description	Note
1	6608203500	Centering mirror	
2	4508212900	Centering lamp	
3	5808531500	Chin support PCB	
4	6208526900	Brake pushbutton	
5	6208525700	Pushbutton centering	
6	6108201900	Centering movement knob	
7	6608223000	Brake Assembly	
8	5608121605	Rear column cover	
9	5608451005	Upper rotating arm cover	
10	5608452101	Digital Sensor cover	
11	6608451200	Fan	
12	6608928000	Digital Sensor kit	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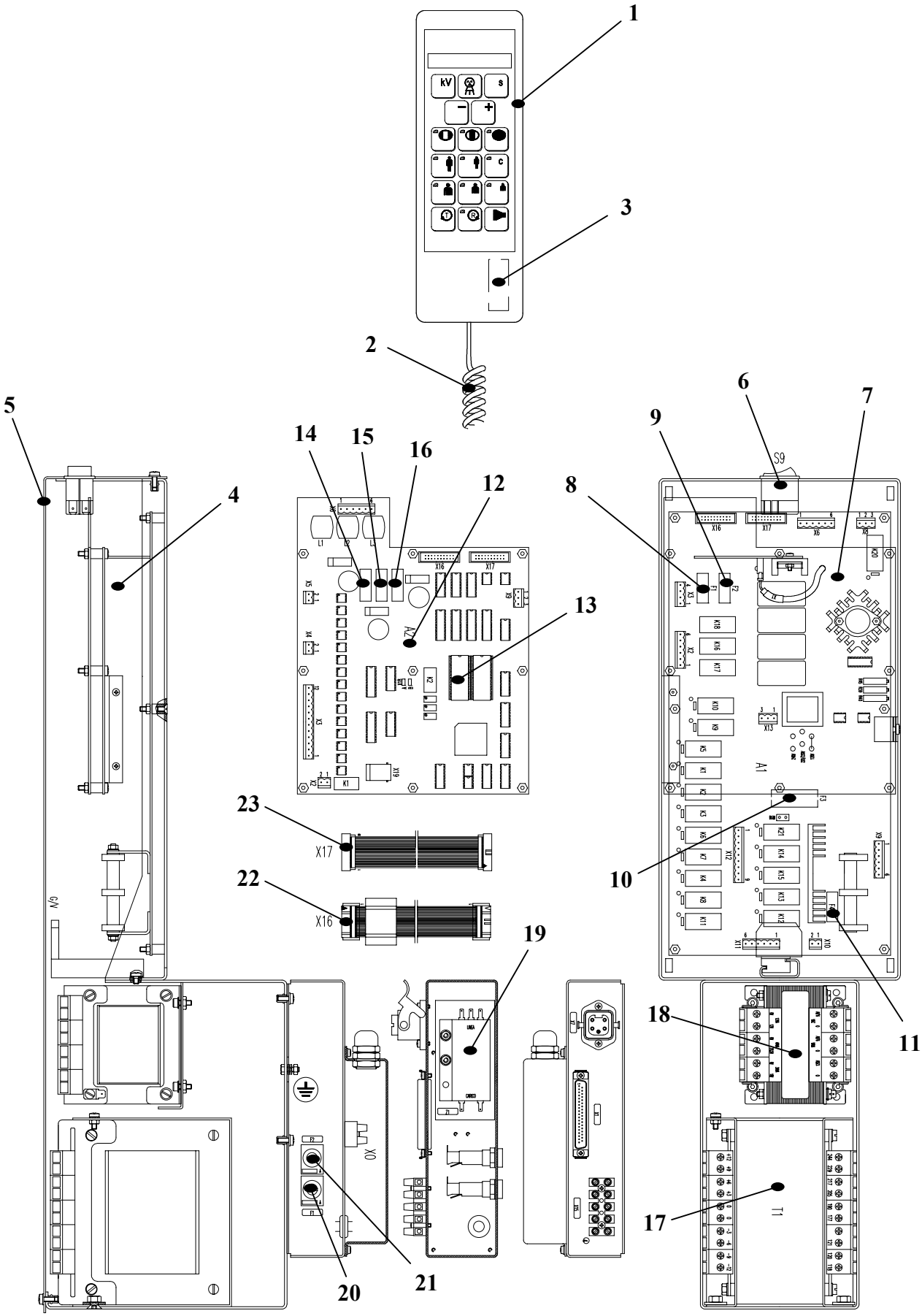
2 – CONTROL BOX

Ref.	Order code	Description	Note
1	7208760003	Hand held control (without cable)	
2	6608746600	Hand held control cable	
3	5808757600	EPROM for remote control	
4	8308762103	Control box complete	
5	5608125405	Control box cover	
6	4291415900	Bipolar switch S9	
7	6608756800	Power board PCB A1	
8	8008600476	PCB A1–F1 fuse 2AT (5 x 20)	
9	8008610107	PCB A1-F2 fuse 3AT (5 x 20)	
10	8008610137	PCB A1-F3 fuse 8AF (6.3 x 32)	
11	2300978300	PCB A1–F4 fuse 315mAF (5 x 20)	
12	5808757000	CPU PCB A2	
13	5808757200	EPROM for CPU board	
14	8008600493	CPU A2 Board – Fuse F1 1AT (5 x 20)	
15	8008610014	CPU A2 Board – Fuse F2 500mAT (5x20)	
16	8008600493	CPU A2 Board – Fuse F3 1AT (5 x 20)	
17	4492819700	Mono-phase Autotransformer T1 (120V)	
18	4492819800	Transformer T2 (120V)	
19	4192207500	Line filter	
20	2300977000	Line fuse F1 10AT (6.3 x 32)	
21	2300974800	Line fuse F2 1AT (6.3 x 32)	
22	6208746400	Flat cable X16	
23	6208741400	Flat cable X17	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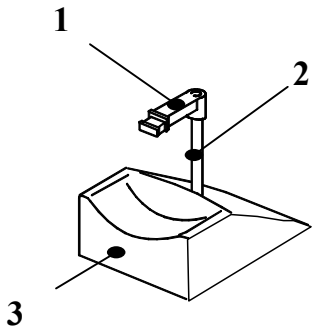
3 – ACCESSORIES

Ref.	Order code	Description	Note
1	4099927000	Kit for 500 Centering clamp	
2	6608906000	Kit for 50 Centering clamp rod	
3	5408529000	Panoramic chin support	
4	5908502000	SINUS chin support	
5	5408902100	Round centering tool	
6	6108910100	Fluorescent screen for X-ray beam centering	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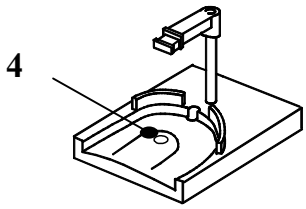
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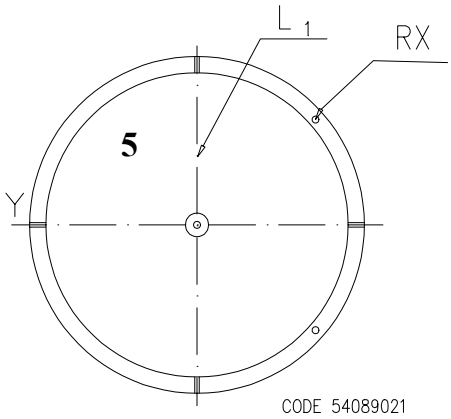
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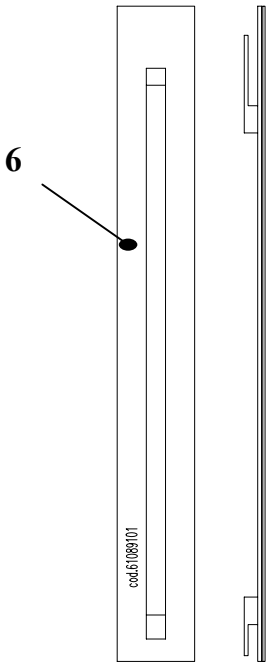
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Cod. 6908919100_Rev.0

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